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THE EXCISION OF JOINTS.

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PREFACE.

EXCISIONS of Joints have been comparatively little practised in the United States. The personal experience of any one American surgeon in regard to them is therefore of a very limited character; and American medical periodicals, or systematic writings, furnish but little material calculated to throw light upon the questions connected with this class of operations.

British, and, to a larger extent, European medical literature offer, however, a fertile field for their study. Owing their origin to an English surgeon, they have of late years been extensively practised throughout the United Kingdom, and a great number of the cases in which the operation has been performed have been published with more or less detail; but, with the exception of Professor Jeffray's translation, in 1806, of the cases reported by the elder Moreau, accompanied by a reprint of the two letters of Mr. Park, and the work of Mr. Syme, printed in 1831, the English language possesses no monograph on the subject of Excisions. On the Continent the interest developed by the early experimental researches of Chaussier, Heine, and Wachter has found expression in the later writings of Ried, Wagner, J. F. and O. Heyfelder, Esmarch, Paul, Schillbach, and in numerous "inaugural dissertations."

From these and other sources the following pages have been prepared, and were offered in successful competition for the Boylston Prize of 1861. As an attempt to exhibit the precise value of an important surgical procedure, it is hoped that they will be found not undeserving of the honor which they have thus received.

Great pains has been taken in the preparation of the tables which accompany the consideration of each excision. It is believed that they are more complete than any heretofore published. In their formation, valuable assistance has been derived from the tables of O. Heyfelder, of St. Petersburg, and in that of excisions of the hip-joint from those of Dr. L. A. Sayre, of New York, and of Dr. C. Fock, of Magdeburg, Prussia. The names of the various operators are omitted as a matter of discretion, some of the cases, or the statement of their final result, having been obtained from private sources, and being unpublished; but, both in the tables and elsewhere, whenever indebtedness to any writer has been incurred, a full and explicit reference is given.

In contrasting the results of amputations with those of excisions, use has been made of the statistical tables of Mr. Thomas Bryant. These are among the most recent, and are drawn up with great care, as well as derived exclusively from British practice and a metropolitan hospital. As this is also true of a large proportion of the tabulated cases of excision, the comparison seems to be a fairer one than it would be with tables compiled from indiscriminate sources.

The accompanying standing votes of the Boylston Medical Committee explain themselves.

"By an order adopted in 1826, it was voted,—

"1st. That the Board do not consider themselves as approving the doctrines contained in any of the dissertations to which premiums may be adjudged.

"2d. That, in case of the publication of a successful dissertation, the author be considered as bound to print the above vote in connection therewith."

R. M. HODGES.

BOSTON, 1861.

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EXCISIONS IN GENERAL.

HISTORICALLY CONSIDERED.

In 1783, Henry Park of Liverpool published a letter which he had written to Percival Pott, proposing excision as a cure for diseases of the knee and elbow joints. This was the first definite allusion made to the subject, and he says he was especially led to the proposal by its having "been the invariable custom at the Liverpool Infirmary, for more than thirty years, to take off the protruded extremities of bones in cases of compound dislocation."[1]

The practice of removing the articulating extremities of dislocated bones appears, however, to be older than the Liverpool Infirmary, for Hippocrates says: "At resectiones ossium perfectæ circa articulos et in pede, et in manu, et in tibia ad malleolos, et in cubitu ad juncturam manus, plerisque quibus resecantur, innoxiæ sunt, si non statim animi deliquium evertat aut quarta die febris continua accedat."[2] And Celsus, in a section on compound dislocations, observes, although more briefly and less definitely: "Si nudum os eminet, impedimentum semper futurum est, ideo quod excedit abscindendum est."[3] Paulus Ægineta also says: "Si extremitas ossis prope articulum (carie) affecta fuerit, resecare ipsam opportet."[1] But in none of the subsequent ancient writers is there more than a mere allusion to the operation; and this, too, without any detail of cases or method of performance.

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[1] H. Park and P. F. Moreau. Cases of Excision of Carious Joints, with Observations by J. Jeffray, (Glasgow, 1806,) p. 72.

[2] De Articulis, LXXIX.

[3] Milligan's Ed., p. 446.

As the book containing the passage quoted from Hippocrates is of very doubtful authenticity among critics, and since Celsus never practised either medicine or surgery, the credit of reintroducing the excision of joints, as a surgical procedure, certainly equals that of its invention, and unquestionably belongs to recent times. Although we are indebted to Mr. Park for the first distinct publication on the subject, yet the credit of the practical demonstration of these operations, and their application to the joints generally, is due to the MM. Moreau, father and son, of Bar sur Ornain, France.

In the "subsequent observations," dated September 10, 1805, which accompany the reprint of his letters, published with additions by Professor Jeffray of Glasgow, Park himself declares that but for Moreau excisions would have fallen into oblivion, and laments that, although the army and navy of Great Britain since their announcement had passed through a long and bloody war, removal of the joint saved the limb of no British subject, notwithstanding he had so strongly urged the propriety of the operation on the attention of military surgeons. (p. 59.) And yet in 1803 the Moreaus had repeatedly excised nearly all the larger articulations, and the younger boasts that their "town has become in some sort the refuge of the unfortunate, afflicted with carious joints, after they have tried all the means usually recommended by professional men, or have had recourse to empirical nostrums, and when amputation seemed to them the last resource."[2]

So early as 1786, experiments were commenced for the purpose of ascertaining to what degree the limb from which a joint had been excised was useful, and whether excisions might advantageously be substituted for amputations. Vermandois appears to have been the first to undertake them, and the dogs from which he had successfully removed the head of the femur were kept in view for long periods of time.[1] The results which he obtained were subsequently confirmed by Chaussier, Köler, and Wachter, who also excised the head of the humerus with success. But operations on the ginglymoid joints, though none of the animals died, were, in the hands of Chaussier and Heine, almost, if not entirely, unsuccessful, the limb hanging motionless and incapable of supporting weight, even at the end of a year from the operation.[2]

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[1] Liber VI. Chap. 77.

[2] Jeffray's Park and Moreau, p. 115.

The impossibility of deducing from these experiments any conclusions, except perhaps as to the risk of life, is too obvious to require comment, since success depends so much upon the after-treatment, which of course could not be applied in such cases. They seem, therefore, to have been of slight practical value, and to have produced but little impression.

Between 1786 and 1789, the elder Moreau presented various memoirs on the subject to the French Academy, but they met with the most violent opposition, and many of his cases now lie forgotten and lost amongst the unpublished papers of that body.[3] As a consequence, excisions, with the single exception of that of the head of the humerus, — which, since 1812, chiefly from the example of Percy, Sabatier, and Larrey, has been not infrequently practised, as well for disease as for gun-shot injury, — were but rarely performed in the early part of the present century. But in 1831, Mr. James Syme of Edinburgh became an earnest advocate for their application to the elbow; in 1845, Mr. William Fergusson of London assumed a similar position with regard to the hip, and in 1850 to the knee joint.

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[1] Journ. de Méd., Vol. LXVI. p. 200.

[2] G. H. Wachter, De Articulis Extirpandis, (Groningen, 1810,) p. 61.

[3] Jeffray's Park and Moreau, p. 82.

Within the last few years, therefore, they have been frequently performed, although it is chiefly in Great Britain that they have been popularized and adopted by the generality of surgeons.

Brilliant in themselves, these operations constitute a striking instance of the tendency of modern times to what Mr. James Prior, in 1844, first called "conservative surgery," though its doctrines, at least so far as the preservation of limbs is concerned, are a century older.[1] As far back as 1745, after the experience of the battle of Fontenoy, a French army surgeon, named Boucher, professed conservatism in these words: "Dans le nombre de 165 blessés il n'y en a aucun que je sache à l'égard de qui la confiance qu'on a eu dans la Nature en pareil cas a été déçue. L'art se réserve de ressources infinies et peut porter à la Nature toutes sortes de sécours pour exempter de l'amputation; au contraire il n'a presque rien à opposer aux inconvéniens qui accompagnent indispensablement l'amputation."[2]

THEIR ADAPTATION TO CASES.

It is only as a substitute for amputation in traumatic lesions, and in certain organic ones, that the proposition of excising the joints has been entertained, excepting in those comparatively few instances in which this operation has been undertaken for the cure of deformities, or in disease of the hip-joint where it is the sole operative alternative.

1. *Excision for Injury.*—The general consent of surgeons has established the propriety, under given circumstances, of substituting for amputation the excision of certain joints affected with traumatic lesions, whether from

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[1] Lancet, Dec. 21, 1844.

[2] Mém. de l'Acad. de Chir., Tom. II. p. 211.

gun-shot or other causes. The weight of favorable testimony is so great as to forbid a difference of opinion. The systematic operations of Hey, Taylor, and Sir Astley Cooper; those dictated by common sense which are occasionally done by almost all surgeons; the decisive opinions of Percy, Larrey, Guthrie, and Hennen, as also the experience of modern campaigns, set forth in the reports of Baudens, Macleod, Stromeyer, and Esmarch, all render a unanimous approval, both of the operation and the results which follow it.

An American authority, Dr. F. H. Hamilton, says: "If we consider the question of the life of the patient only, the argument and the testimony seem to favor resection in a great majority of cases of compound dislocation occurring in large joints, and in a considerable number of cases in the smaller joints. It is certainly more safe than non-reduction, or reduction without resection, and it is probably quite as safe as tenotomy. . . . . . There seems sufficient authority in the facts collected to conclude that resection is applicable to certain compound dislocations of the clavicle, humerus, radius and ulna, fingers, femur, tibia and fibula, and toes."[1]

It is to be borne in mind, with regard to the success of excisions in military practice, that the different circumstances of campaigns, or even of battles, greatly modify the character of injuries, of operations, and their results.

Take, for example, the change in the nature of wounds brought about by the introduction of conical bullets. A Crimean surgeon says: "When the old round ball strikes a bone such as the femur, it does not necessarily penetrate its spongy substance or comminute its shaft. If it does, although the injury is sufficiently great, it is a perfect bagatelle to the effects of the conical ball, which, seldom deflected from its course, grinds through the spongy bones, breaking up their laminæ, shatters the shafts of long bones, driving the splinters into the medullary canal and among the surrounding soft parts, and frequently fissures the rest of the shaft as far as either epiphysis."[1] Here are circumstances which must affect not only the results of any operations, but may even exclude excisions from amongst those of feasible performance.

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[1] Treatise on Fractures and Dislocations, (Philad., 1860,) p. 712.

Or, comparing the siege of Sebastopol and its organized hospitals, to which soldiers could be admitted within an hour or two of their accidents, and treated until the natural termination of their cases, with the more recent Italian campaign, where the army was always on the move, its ambulances in the open field, under a summer's sun, with perhaps insufficient means, either personal or material, and it is easy to conceive that a difference of mortality must follow operations performed under such varying conditions.[2] Such a contrast is well presented in a careful paper on Injuries of Joints, by Mr. R. Alcock.[3] He gives the following table, derived from the occurrences of a single year of the Peninsular War.

Circumstances.	No. of Wounded Joints.	No. of Amputations.	Total No. of Deaths.
Favorable,	43	19	10
More or less unfavorable,	39	18	24

From which it appears, that about the same number of amputations were practised in each set of cases, viz. in rather less than one half of the wounds, but that the mortality of the second class more than doubled that of the first. These statements certainly go far to show with how little assurance inferences for the future can be drawn from the past, in a matter involving so many considerations as military surgery.

The fact cannot, however, be concealed, that excisions, excepting those of the head of the humerus and of the elbow, which seem to be especially privileged, are not operations liable to succeed under any circumstances in the hospitals of an army. Discussing this question, M. Scrive says: "L'expérience acquise en Crimée sur les intéressantes questions qui concernent les amputations a démontré que ces moyens d'extrême ressource doivent être, à la guerre, largement appliquées. Si l'on hésite dans les cas paraissant douteux, ou si l'on se place un peu trop sur la terrain dite conservatrice, on ne tardent pas à s'en repentir, et à voir succomber aux suites de leur blessures des blessés que souvent l'amputation aurait pu sauver. Nous avons fait trop souvent cette triste experience. Entraînés par un sentiment de cœur qui s'appuyait sur une espérance trompeuse, nous tentions pour le plus grand interêt d'avenir d'un officier, par exemple de lui conserver un membre et de lui permettre de continuer par ce bienfait la brillante carrière des armes; le sort se jouait de nos efforts, et les conditions générales mauvaises de la santé publique, les difficultés d'une hospitalisation encombrée et insalubre finissaient par conduire l'infortuné blessé au tombeau."[1]

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[1] Edinb. Monthly Journ. of Med. Science, July, 1859, p. 67.

[2] The practice of conservative surgery was very limited in Italy, and in the lower extremity almost abandoned, early amputation being performed instead. Syst. of Surg. by T. Holmes, (Lond. 1861,) Vol. II. p. 95.

[3] Med.-Chir. Trans., Vol. XXIII. p. 294.

2. *Excision for Deformity.* — With reference to its adaptation as a means of curing deformities, (and in this term, as here used, hardly anything but the varying forms of anchylosis is included,) apart from the great danger and the uncertainties belonging to the operation itself, questions of expediency arise having reference to the patient's position in life, to the degree and nature of the deformity, and to the extent of its interference with absolutely necessary uses or pursuits, which are not always of easy decision, and which admit of discussion only in certain cases, and with regard to particular joints. Mr. Bryant speaks of a painter who desired anchylosis of his

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[1] Rélation Médico-Chirurgicâle de la Campagne d'Orient, par le Dr. G. Scrive, (Paris, 1857,) p. 461.

arm in a straight position; and of a turner, whose knee, at his own request, was permitted to stiffen at a right-angle, as that position allowed him to turn his wheel.[1] Such instances serve to show that the deformities usually considered to justify treatment by excision do not always render a limb useless, or necessarily prove a hindrance to self-support.

3. *Excision for Disease.* — The organic lesion most frequently treated by excision is what is familiarly called "white-swelling," — a term implying formidable disease of the joint, having no specific character, usually occurring in unhealthy constitutions of the sort called strumous or scrofulous, sometimes spontaneous and sometimes resulting from injury, and which gives place to a returning healthy condition slowly, if at all. Its most prominent characteristics are a degeneration of the synovial membrane into a fibro-gelatinous mass, (distinct from anything following acute synovitis,) ulceration of the cartilages, and caries of the articular extremities of the bones, from either one of which structures the disease may have taken its point of departure. Whilst its milder forms sometimes admit of recovery with anchylosis, the graver cases pass on to a condition in which the total destruction of the cartilages and ligaments, and the separation of particles or considerable portions of diseased bone, destroy the possibility of recovery. Especially is this the case in those not infrequent instances where the cartilage is detached in flakes, or, as it is called, is "shed." The separated pieces, with the exfoliated bone, acting within the joint as foreign bodies, an unhealthy inflammation is set up in the contiguous tissues, the spongy structure of the bone becomes infiltrated with pus, abscesses form, and sinuses burrow into the soft parts. The outlets for discharge being insufficient, the contents

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[1] Diseases and Injuries of Joints, (Lond. 1859,) p. 121.

of the joint are tardily removed, and the changes which take place are so slowly performed, that the local trouble not uncommonly reacts upon the general health, and life is only preserved by the sacrifice of the joint or the limb.

No diseases are more difficult of exact diagnosis than those of articulations. Experienced surgeons are deceived as to the expected condition of an opened joint, and daily observation shows the impossibility of determining with confidence the precise nature or amount of disease, even in cases apparently demanding the grave alternative of amputation or excision. This is perhaps the reason why the question, when and to what degree excisions, applied for the cure of organic lesions, are certain, or even likely, to be followed by success, is still so far from being definitely settled; any favorable inferences capable of being drawn from operations performed for injuries becoming inapplicable to those for disease, when it is remembered that the latter occur in, or are originated by, a predisposing unhealthy state of the constitution.

It is not to be forgotten that, even in cases of very considerable severity, disease of a joint will sometimes, after proper local and hygienic management, result in a cure, — in the upper extremity with a fair amount of motion, in the lower with more or less anchylosis. This is especially true of cases occurring in early youth; the natural powers, under favorable influences, usually sufficing to effect a cure; and if the disease is too severe to admit of this, it will very often be found associated with a constitutional state incompatible with healthy reparative action of any kind. In advanced life, affections of the joints are rare; and when occurring, the subjects of them are usually unfitted to bear the exactions of long continued disease, or the slow convalescence from an operation.

Time, unassisted and alone, is of itself a powerful curative agent. "When I see," says Vidal, "the haste with which some surgeons avail themselves of terrible resources, before *time* has had its fair chance, I can only commiserate both the patient and the surgeon. By its aid we gain the benefit of rest or of medicines, or medicinal waters, which produce effect only after long and persevering administration, or of a change of climate, which, modifying the whole organism and changing the temperament, sometimes cures diseases which more than once the saw and the knife have itched to remove."[1]

The powerful influences of Hygiene, well appreciated by the founders of infirmaries at Margate, Harrowgate, and Southport, on the southern coast of England, for convalescents and others from the London hospitals, and at Berck, near Calais in France, for scrofulous children from the Paris hospitals, are graphically described by a writer, who says, that a visit to these institutions "will afford to any one an accumulation of evidence of the wonderfully invigorating influence of the sea-shore. There he will see carious tarsi, which, according to the ordinary principles of surgery, suggest no other alternative as regards treatment than that between Syme and Chopart; joints already condemned to excision, diseased cervical vertebræ, in which a little further progress must be sudden and certain death; hideous cases of lupus and of so-called glandular swellings; — in all these and many other forms of disease, the immediate result of removal to the sea air is the manifestation of a tendency to a favorable termination which did not before exist. Ill-conditioned sores, the sure indices of dead bone beneath, assume a healthy aspect; sequestra, which under other circumstances would require the knife for their removal, become imprisoned in newly-formed bone and disappear; and a disease (caries) to which, according to a very high authority (Mr. Syme), there is no natural limit except the life of the patient, terminates spontaneously in cure. Even in those cases in which the knife cannot be wholly dispensed with, the surgeon operates under circumstances most conducive to a favorable result."[2]

There is, therefore, a *preservative* as well as a *conservative* surgery of diseased joints.

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[1] Tr. de Path. Ext., Tom. V. p. 567; see also Lancet, Mar. 23, 1861.

[2] Brit. and For. Med.-Chir. Rev., Jan. 1856, p. 85.

EXCISIONS AND AMPUTATIONS CONTRASTED.

THERE are certain essential peculiarities belonging to excisions, as contrasted with amputations, which characterize them as mere operations, and are not without influence on their results. They have to do with the cancellated structure of the extremities of bones, which widely differs from the dense and non-vascular shaft implicated in amputations, and, instead of one small surface, present two large ones, filled with numerous veins, remaining patulous in the canals which contain them. These are especially adapted, if excited by the admission of air, the friction of the opposing part, or the irritation of bone-dust left in the cancelli, to set up profuse suppuration, to engender phlebitis, myelitis, and the conditions most favorable to pyæmia and the formation of purulent deposits. They are frequently performed in the midst of more or less disorganization of the soft parts, and although the change for the better which takes place in these on the removal of carious and dying bone may be rapid and remarkable, amputation has always the advantage of being undertaken only upon healthy tissues. Extreme degeneration is considered by some to be decisive against excision.

Little comparatively is required of a surgeon after an amputation. The consequences of its management, whether skilful or otherwise, can only show themselves in a good or a bad shaped stump; but in the treatment, and, as it is sometimes technically called, "the putting up" of an excision, want of skill or care endangers the limb, if not the life; a serviceable and comely result depends upon patient personal superintendence, and upon well-chosen and well-fitting apparatus.

So much being said against excision as compared with amputation, it may be urged on the other side, that an excision ought to be, theoretically, safer than the amputation it supplants, since the latter must be performed at a point nearer the trunk; for it has been indisputably proved, by surgical statistics, that the mortality after amputation increases, *cæteris paribus*, in exact proportion as we approach the trunk, every additional inch removed augmenting the danger to the patient. This is well shown in the statistics drawn from Crimean experience, which present the following results illustrating this progressive mortality.[1]

Amp. at shoulder-joint,	33.4	Amp. at thigh (middle third),	60.0
" of arm,	26.4	" " (lower third),	56.6
" of fore-arm,	5 0	" at knee-joint,	55.5
" of fingers,	0.9	" of legs,	35.6
" at hip-joint,	100.0	" at ankle,	16.6
" at thigh (upper third),	87.0	" at medio-tarsus,	14.3

The same fact is also made apparent in Malgaigne's statistics of amputations for disease, derived from the hospitals of Paris, and which give for the foot a mortality of 10.34, for the leg, 48.58, for the thigh, 60.78 per cent; for the fore-arm, 29.41, the arm, 39.34, and the shoulder-joint, 50.0 per cent.[2]

Besides the above consideration, it may also be observed, that no nerves of any size are divided, and, the large vessels being untouched, hemorrhage at the time of the operation, and the liability of its occurrence secondarily, are very much less than in amputations. The shock, too, is undoubtedly less, since the blood contained in the limb is not lost; but in saying this, it must not be forgotten that the shock is very great, and that death from it does sometimes occur, especially after excision of the larger articulations.

Simply because the operation is less fatal, is not, however, a sufficient reason for excision to replace amputation. Indeed, it will be found that in this respect there is actually but little difference between them. The real question at issue is, whether, all things considered, amputation can be averted, excision substituted for it, and the *usefulness* of the limb preserved in a sufficient degree to render the operation an improved method of surgical treatment; and into this question the consideration of mortality does not enter, except so far as to give assurance that the preservation of the limb is not bought at such an additional sacrifice of life as to more than compensate for the advantages gained. The merits of this question will be examined in connection with the individual excisions.

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[1] Notes on the Surgery of the Crimean War, by G. H. B. McLeod, (Lond. 1856,) p. 433.

[2] Arch. Gén. de Méd., Avril et Mai, 1842.

EXCISIONS CONSIDERED IN THEIR ADAPTATION TO THE TWO EXTREMITIES.

It need hardly be said, that a great diversity exists in the applicability of this operation to the different joints of the two extremities. An excision in the lower extremity, which is designed to support the weight of the body, and is the chief agent in locomotion, had better have given place to amputation, unless the limb regains, as its result, a certain amount of positive usefulness. On the other hand, an excision in the upper extremity, — which, with gentler movements to execute, has no weight to sustain, acts independently of its fellow, and admits of exercise and locomotion during the processes of cure, — even if unsuccessful, leaves the body certainly, and the limb probably, no worse than before the operation. An arm may be shortened, arrested in growth, deprived of certain uses and limited in others, and still remain of the greatest service. This difference is still further shown, when the admirable substitutes for the lower extremity which mechanical ingenuity has furnished are remembered, whilst the most imperfect and partial motions of the hand surpass in usefulness those of the best artificial contrivances which have yet been invented.

The extent to which the removal of bone is admissible varies for the two limbs, and so consequently, in certain cases, does the propriety of excision. If the disease of a knee-joint be so considerable that its removal renders necessary an amount of mutilation such that the bones when opposed would have an insufficient basis for support, excision cannot be the appropriate operation; yet we may have 14½ inches of the bones of the upper extremity taken away without the usefulness of the limb being altogether destroyed.[1] Still, anything short of the most complete removal of the disease is entirely inadmissible. For success depends on the contact of the healthy surfaces, and incipient carious bone, if unremoved, will render the best efforts unavailing. Gouging, as a substitute for the saw, is, consequently, a questionable proceeding, and only admissible when it leaves behind a surface which bleeds at all points. It might well be made an established rule, that excision should never be commenced except as an exploratory operation, to be continued, or to give way to amputation, as circumstances should indicate.

RESULTS OF EXCISIONS.

WHETHER performed for injury, for deformity, or for disease, it is to be remembered that useful and serviceable results, as a rule, are never attainable in less than a year, and often not until even a longer period, after the operation. This slow convalescence is perhaps one of the most serious objections to the operation, and shows how desirable it is that the subjects of it should not be worn out by previous suffering, or of so advanced an age that the blood shall have lost those elements on which the success of reparative processes depends. The importance, therefore, of a judicious choice between excision and amputation is enhanced by other considerations than those belonging to the mere preservation of the limb; for a patient may make a good recovery from an amputation, performed at the outset, when he would not survive an ill-advised excision, much less an amputation required by its failure.

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[1] Blackman's Ed. of Velpeau's Elements of Op. Surg., Vol. II. p. 457.

Excisions are sometimes only partially successful; and it cannot be kept out of sight, that many of these operations, especially those performed on the lower extremity, the subjects of which were discharged from hospitals at the close of a long treatment in an apparently satisfactory condition, and with every promise of a useful limb, have ultimately proved failures, either from a return of the disease in the bones, the persistence and aggravation of sinuses and fistulæ thought to be insignificant and unimportant, the imperfect adaptation of the opposing bones, the gradual yielding of the union and the development of lateral curvature or angular deformity, the cessation of growth, or a variety of other causes not always to be anticipated, or even prevented. Many such results of cases operated on in the earlier days of excisions have been reported within the last year or two, and will again be referred to in the appropriate place.

The deformity entailed by the operation of excision, even in the most successful cases, is by no means inconsiderable.

In the upper extremity a considerable imperfection in the motions of the new false joint must occur. Where mobility is desired, and not anchylosis, as in the shoulder and elbow, it is only in rare and comparatively exceptional cases that the bones become rounded and play smoothly upon each other; the flexibility of a ligamentous union, in all ordinary cases, giving the limited mobility attainable.

In the lower extremity the shortening necessarily following excision becomes a deformity which may be unimportant in the upper. This of course varies in degree; a thick sole, or a high heel, may, in some instances, compensate for it very satisfactorily, but when it is "six or seven inches," or the deformity requires "the aid of a leather case at the knee," or "a boot propped up by two steel rods seven inches long," or such an appendage as that represented in a drawing accompanying the report of an excision of the knee performed by Dr. G. Buck of New York,[1] a doubt may arise, even if the unfortunate subjects are able to "work hard," whether an artificial limb would not be an improved substitute for so mutilated a member.

Whether later experimental researches will lead to a lessening of these after-deformities remains to be seen. Some recent researches on the functions of the periosteum, and the artificial reproduction of bone, have made M. L. Ollier, of Lyons, sanguine enough to hope so. He says: "Dans une résection l'art ne doit plus se borner à enlever les parties alterées, il doit aussi viser à faire réproduire les fragments osseux qu'il a sacrifié. La physiologie expérimentale nous en indique le moyen, elle nous apprend pourquoi les résections pratiquées jusqu'ici ont été si exceptionellement suivies de régeneration et nous révèle ce qu'il faudra à l'avenir. La conservation du perioste doit être une indication de premier ordre. Dans un travail recent, (Des Moyens Chirurgicaux de favoriser la Réproduction des Os apres les Résections, Paris, 1858,) nous avons cherché à établir que, malgré des difficultés inhérentes à certains conditions anatomiques et physiologiques, cette indication était toujours réalisable, partiellement du moins, et nous avons démontré que l'observation clinique en avait déjà pleinement confirmé la justesse."[2]

On the other hand, the experiments of Heine tend to show that it is only in the rarest cases that the deficiency of bone is replaced; still more seldom that the mass of new bone possesses the form of that which was removed. The periosteum plays the principal part in this repair, but the reproduction takes place to some extent without it. The exudation necessary for the regeneration of bone appears to be furnished by all the tissues.[1]

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[1] Am. Journ. of Med. Sc., Oct. 1845, p. 282.

[2] Journ. de Phys. de B. Sequard, Janv. et Avril, 1859.

The researches of M. Bourguet,[2] derived from clinical observation, and made since those of M. Ollier, confirm the opinions of Heine.

The most frequent causes of fatal results after excisions are either those common to all large operations, or those due to the age of the patient, or to the general constitutional state which accompanies the condition requiring interference. It is not probable that the time of operating has much influence on the issue. In military practice there is doubtless a choice in the time when operations for traumatic lesions should be performed; but in civil practice, and for disease, it is not so necessary to be governed by predetermined rules. In the latter it is the general and constitutional condition, more than the local one, which tells the surgeon — let the disease be just commencing or fast approaching a fatal termination — what is to be gained or lost by waiting; whether the constitutional state existing — excited perhaps by the long-continued irritation of the local condition, rather than by a natural predisposition — may not rapidly improve on the removal of the exciting cause; whether the long ensuing confinement can be borne, or whether it is altogether beyond the reach of cure by operation. These are questions not to be decided by any arbitrary rules.

One cause of fatal and unsuccessful results deserves, however, to be specially mentioned. No fact connected with the history of excisions is better established than that such results generally follow partial operations, especially in the ginglymoid joints; i. e. operations in which a portion of the articulating surface and synovial membrane is left untouched. Union does not readily take place between osseous and cartilaginous surfaces brought into apposition; the cartilage almost invariably separates, slow exfoliation taking place; and necrosis, or the disease for which the operation was undertaken, is very apt to be set up in the part remaining untouched. This contingency was long since alluded to by Mr. Syme[1] in the following words: "With regard to the cartilage, it might be expected that no harm could result from leaving any part of it that remained sound; but here too the judgment of theory is reversed by experience, since it has been found that, when any portion of the articulating surface was left, the disease required a subsequent operation. The cause of this is probably to be referred, not so much to any morbid process in the cartilage itself as in the synovial membrane lining it, and in the spongy bone immediately subjacent, which has its tendency to morbid action excited by the injury sustained in its neighborhood. The operation, therefore, requires the removal of the whole cartilaginous surface."

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[1] On the Process of Repair after Resection and Extirpation of Bones. By A. Wagner. New Syd. Soc., Vol. V. p. 156.

[2] Lancet, Aug. 25, 1860, p. 200.

Of the truth of this statement, the succeeding pages will afford abundant proof.

The question has been raised whether excision was more frequently performed, and less successful, on the left side of the body than on the right. Of the 709 excisions of large joints for organic lesions, comprised in the tables contained in the following pages, 427 recovered, and 282 resulted in death, amputation, or very incomplete success. The side is mentioned in only 311, viz. 152 right and 159 left. Of the failures occurring in these 311 cases, 57 were of the left side and 48 of the right. Of 269 excisions for traumatic lesions, 207 recovered and 62 died. The side is mentioned in only 95 cases, viz. 49 left and 46 right, and of 25 deaths occurring in these, 17 were of the left side and 8 of the right. These figures indicate, therefore, that there is but slight ground for considering the left side as more prone to disease or injury, or less fortunate, unless perhaps in traumatic cases, in the result of operations performed upon it.

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[1] On Excision of Joints, (Edinburgh, 1831,) p. 19.

The percentage of failure in these two classes of cases added together is 35.17. In Paul's table of 1128 excisions of all sorts, which includes many operations not entitled to be classed as such, and where cases are enumerated over and over again, the rate of failure is 27.47 per cent.[1] In a similar table collated by O. Heyfelder, the percentage is 28.82.[2]

In face of the facts which have accumulated, the propriety of excising joints cannot be gainsaid. As in all mooted questions, we find positions which are untenable assumed under the compulsion of controversy, party feeling, and rivalry; common sense carried away by enthusiasm; and various agencies so influencing the motives of most of those who have yet written or expressed themselves on the subject, that it well admits of being examined afresh from an impartial point of view.

The uncertainty which characterizes all excisions shows that there remains something yet to be learned. Mr. Fergusson remarks upon the singularity of the fact, "that out of the three cases (of excision of the knee-joint) he has operated on, the successful one was the worst, those who have not got well not having had so great an amount of disease in the joint as the one who recovered."[3] And a British medical officer says, in speaking of the wounds of joints in the Crimea: "In the management of no accidents was so much expected from modern improvements, and by none were we so much disappointed."[1]

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[1] H. J. Paul, Die conservative Chirurgie der Glieder, (Breslau, 1859,) p. 40.

[2] Operationslehre und Statistik der Resectionen, (Wien, 1861,) p. 395.

[3] Lancet, April 22, 1854.

At the present time, the value of a limb from which the joint has been excised, the comparative dangers of the operation, the joints to which experience shows it to be properly applicable, and the conditions of disease or injury under which it may be performed, as well as the extent and manner of operative interference, can all be estimated better than ever before.

Excision of the lower jaw seeming to constitute a distinct subject, and that of articulations like the sterno-clavicular, acromio-clavicular, costal, &c., being of such exceptional performance as to forbid appreciation, the consideration of the operation as applied to the joints of the extremities will alone be discussed in the following pages.

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[1] Edinb. Monthly Journ. of Med. Sc., July, 1859, p. 67.

EXCISIONS OF THE UPPER EXTREMITY.

SHOULDER-JOINT.

HISTORY.

It has been claimed that M. Boucher, of Lille in France, after the battle of Fontenoy, which was fought May 11, 1745, first introduced the practice of excision in place of amputation, by extracting through the wounds made by gun-shot injuries the fractured portions of the articular extremities of bones, and especially those entering into the formation of the shoulder-joint.[1] But, as Baron Percy justly remarks, the course adopted by this distinguished surgeon was unpremeditated, and he never contemplated laying down a law which only a few chance cures could sustain; — like M. Jourdain, "Il a fait de la prose sans le savoir." Indeed, the head of the humerus had been already removed in August, 1740, by M. Thomas, of Pezenas, in Languedoc; the case, however, appears to have been one of necrosis, where an extraction of the dead bone was effected in the course of several operations, rather than by a regular excision.[2]

In April, 1768, Mr. Charles White, of Manchester, England, removed a large portion of the upper part of the humerus. Mr. White had previously excised the head of the bone in the dissecting-room, but this he claims to have been the first instance of the operation performed upon the living subject. His claim has been generally recognized, but the history of the case proves it to have been one of necrosis, and a glance at the engraving accompanying the report shows very plainly that the head of the humerus remained unremoved in the glenoid cavity, the sequestrum, a portion of the shaft, having separated at the epiphysial junction.[1] The case itself is noteworthy, if on no other account, for the attention which it attracted, and as having led the way to nearly all which has since been accomplished in this department of surgery, no allusions to excision being complete without reference to it.[2]

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[1] Mém. de l'Acad. de Chir., Tom. II. p. 211.

[2] Mém. de l'Inst. Sc. Math. et. Phys., Tom. V. p. 367.

The excision so often attributed to Vigaroux, of Montpellier, in 1767, is shown by a letter of his to Sabatier to have been an operation precisely analogous to that of Mr. White, the head of the bone having been left, retained in its place by the capsular ligament.[3] Of the case of David, of Rouen, referred to by Roux and Boyer as having occurred about the same time as those of White and Vigaroux, I know nothing, except that it was first published in 1803 or 1804, the work in which it is detailed not being procurable.[4]

In April, 1770, the head of the humerus, separated from its shaft by an arthritic disease, the nature of which is not apparent from the description, was removed by Ridewald. The operation was performed whilst the patient, a man fifty years old, was in a wretched condition, and the limb was finally amputated on account of suppuration and hemorrhage, and he died three weeks afterwards of hectic.[5]

In October, 1771, Mr. James Bent, of Newcastle, England, formally excised the head of the humerus for caries of three years' standing, with entire success. His account of the case was published in 1774, and it is undoubtedly the first authenticated instance of this operation for disease,[1] although in the same year, according to the brief statement of Jaeger, it was also performed by a German named Lentin.[2]

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[1] Philos. Trans. Lond., Vol. LIX. p. 39.

[2] White's name is usually spelled by Continental writers "Withe," or "Whytt."

[3] Mém. de l'Inst. Sc. Math. et Phys., Tom. V. pp. 371 – 373.

[4] David (fils), Dissert. sur l'Inutilité de l'Amp. des Membres, etc. Paris, An XI.

[5] Wachter de Artic. Extirp., etc., (Groningen, 1810,) p. 68.

In August, 1778, Mr. Daniel Orred, of Chester, performed, and in 1779 published the account of, a similar operation for caries, of three years' standing, in a man of forty.[3]

In July, 1786, the elder Moreau operated upon the shoulder-joint of a young woman from Cousance, removing the head of the humerus, the glenoid cavity, and a portion of the acromion. The result was a remarkably successful one, and the case is the first in which complete excision was performed.[4]

Baron Percy, stimulated by the example of Moreau's operation, at which he assisted, excised the head of the humerus twice before 1789, and in 1794 showed to Sabatier, then Professor of Surgery at Paris, nine soldiers who owed the preservation of their arms to this excision, and who, as he says, "s'en servent maintenant pour exercer et cultiver des talens, soit utiles, soit agréables, ou pour subvenir à leur bésoins par des travaux plus pénibles." In 1795, this surgeon had operated nineteen times,[5] and at his instigation, "a short time after 1794, a medal was granted by the Academy of Sciences to M. Fernire, of Moux, near Paris, as an honorary reward for a successful removal of the head of the humerus in a boy, aged fourteen, whose arm two of the most celebrated surgeons in France at that time had recommended to be amputated at the joint."[1]

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[1] Philos. Trans. Lond., Vol. LXIV. p. 353.

[2] M. Jaeger. Operatio Resectionis conspectu chronologico adumbrata, (Erlangen, 1832,) p. 3.

[3] Philos. Trans. Lond., Vol. LXIX. p. 6.

[4] Jeffray's Park and Moreau, p. 162.

[5] Dict. des Sc. Méd., Art. *Humerus.*

In 1812, Sabatier, Larrey, Willaume, and Bottin were successful operators in cases of gun-shot injury, as also was the younger Moreau for caries in two instances, and a third time in 1815. In succeeding years, the names of Textor, Roux, and Jaeger are found associated with equally fortunate results.[2]

In 1826, Mr. James Syme, of Edinburgh, reported the details of an excision, and remarked that until then, since the time of Messrs. Bent and Orred, no British surgeon, so far as he knew, had recorded a single instance in which caries or other disease of the shoulder-joint had been cured by this means.[3] In July of the same year the above-named surgeon had a second case, and in fact, from the year 1812 onwards, the operation appears to have become an established one, performed with almost uniform success.

In the United States, it was first practised for gun-shot wounds by Dr. William Ingalls, of Boston, in the winter of 1812-13. The patient was a soldier in the United States army, and he recovered with a tolerably useful limb.[4] It was also performed by Drs. Brown, Walker, and Mann, surgeons attached to the American army, after the battle of Plattsburg, September 11, 1814;[5] and the first time for disease by Dr. Ninian Pinckney, U. S. N., January 6, 1842.[6]

Excision of the shoulder-joint, usually only partial, has been performed for traumatic causes, and for disease. In cases of anchylosis the operation can hardly be considered admissible, provided that be the only reason for doing it, since the mobility of the scapula and the range of motion in the fore-arm compensate so considerably for stiffness in the joint. Moreover, anchylosis of this articulation after disease is of extreme rarity, there being (in 1855) in the museums of London and Paris but four specimens illustrating such a condition.[1]

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[1] Guthrie on Gun-shot Wounds, p. 464.

[2] Jaeger. Op. Resect. consp. chron. adumb., p. 3.

[3] Edinb. Med. and Surg. Journ., Vol. XXVI., (1826,) p. 49.

[4] Communicated by an eyewitness of the operation.

[5] Medical Sketches of the Campaigns of 1812, '13, and '14, by J. Mann, (Dedham, 1816,) p. 208.

[6] Am. Journ. of Med. Sc., Oct. 1846, p. 331.

EXCISION FOR INJURY.

THE advanced position of the soldier's shoulder, when in the act of firing, makes it an event of not infrequent occurrence for a bullet either to bury itself in the head of the humerus, or to traverse it without much comminution, or, striking immediately below it, to break the bone short off. Under other circumstances, heavier projectiles, grape-shot, cannon-balls, and fragments of shell, lay open and fracture the joint, and carry away, perhaps, a portion of the deltoid muscle. In the Crimea, according to the French *résumé*, in open engagements, the superior extremity was wounded once in every 4.3, and in siege operations, once in every 6.2 of all wounds reported.[2] Of 47 gun-shot wounds of the upper extremity, 28 were of the shoulder and arm.[3]

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[1] Med.-Chir. Trans., Vol. XXXVIII. p. 95; Lancet, April 20, 1861.

It appears, however, that the head of the humerus has recently been removed on account of a deformity, resulting from injury received during birth, which is described as anchylosis and "extreme rotation at the shoulder-joint, with the hand behind the back." The nutrition and innervation of the limb were impaired, and the patient could exert but little power in its use, though the scapula moved freely on the trunk. Under these exceptional circumstances the head of the bone was excised by Dr. Alfred C. Post, of New York. The result of the case I am unable to give. (American Medical Times, Feb. 9, 1861.)

[2] G. Scrive, Rélation Méd.-Chir. de la Campagne d'Orient, (Paris, 1857,) p. 443.

[3] Dublin Quarterly, Aug., 1859, p. 27.

Not to particularize the cases susceptible of treatment by excision, it may be briefly said, that it is appropriate to all injuries of the shoulder-joint, where amputation would otherwise be necessary, which are not accompanied by too great destruction of the soft parts, or damage to the great vessels and nerves, and where the bone is not too much comminuted or splintered in the shaft. M. Baudens, one of the best modern authorities on this subject, regards the indications for excision as absolute — excision the rule, and amputation the exception — in all injuries of the head of the bone by a ball, even when fracture extends to the diaphysis and into the medullary cavity. "In four cases," he says, "we were content to remove the head of the humerus, without minding the fissures which ran more or less down the shaft of the bone into the medullary cavity, and recovery took place just as if these fissures had never existed."[1] In the Schleswig-Holstein campaign, so much as four to five inches of the shaft were removed with the head, and without detriment to the result.[2]

As gun-shot wounds are of so variable a character, injuries to the coracoid and acromion processes, to the clavicle, and more rarely to the body and neck of the scapula, will sometimes be found complicating that of the humerus. Although extensive fracture of the scapula destroys the probability of success (Stromeyer), fragments of it have been removed or left to exfoliate without essentially modifying the result, although considerably increasing the suppuration and protracting the time of recovery. Complete excisions have been successfully done by Guthrie, Mann, Larrey, Lauer, Baudens, and others. Larrey's case[3] was remarkable for the extent to which bone was removed, (head of humerus, humeral end of the clavicle, and acromion process,) and for its recovery with considerable use of the arm. Decapitation of the humerus is, however, alone required ordinarily.

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[1] Translation in Amer. Journ. of Med. Sc., July, 1855, p. 242.

[2] Statham's Stromeyer and Esmarch, p. 65.

[3] Mém. de Chir. Milit., etc., (Paris, 1812,) Tom. II. p. 179.

Sometimes only a portion of the head of the humerus need be removed. Such operations were practised in the Crimea. The after-mobility, it is said, was more restricted than when the whole extremity of the bone was taken away.[1] Unfortunate results do not, however, as a rule, seem to follow partial excision of this articulation, as they do in other joints. Yet a case of exfoliation of the glenoid cavity, after removal of the head of the humerus, is mentioned by Larrey.[2]

The considerations already advanced render excision equally applicable to some cases of compound and of comminuted fracture of the neck of the humerus, as well as to compound dislocation, from other than gun-shot injuries.[3] Mr. H. Hancock, of London, has also operated, a month after the accident, for a separation of the epiphysis from a blow.[4] The last-named accidents (compound dislocation and separation of the epiphysis) are of great rarity, and their treatment, therefore, is not amenable to fixed rules; moreover, in drawing inferences from military practice, it is to be remembered that its exigencies often require operative interference of a grave character, where in civil practice more temporizing measures might be adopted. Although a shattered head of the humerus may recover without operation, it is claimed by many, (Esmarch, Petruschky, Kyriakos,) that more rapid and better results, to say nothing of greater safety, follow excision, than the gradual exfoliation of fragments; that the time required, and the condition left, by the slow processes which accompany the latter course, are more unlikely to give a useful arm. As the operation can be performed with equal if not greater success after the establishment of suppuration, a certain amount of delay, even beyond that period, will hardly interfere with the character of its results.

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[1] Macleod, *op. cit.*, p. 332.

[2] *Loc. cit.*

[3] Hamilton, Treatise on Fract. and Disloc., p. 723.

[4] Lancet, July 6, 1850.

Comparatively rapid recovery follows excision for injury. Soldiers, in several instances of its performance in the Schleswig-Holstein campaign, in the Crimea, and the last Indian mutiny, returned to their regiments, or to a modified duty, before the end of the war.[1] The soft parts, being in a healthy condition, take on reparative action readily, and it is only deferred by the presence of some foreign body in the wound, exfoliation, or the irritation of a detached but unremoved fragment of bone. Instances are recorded of recovery in two and three months;[2] but this probably means that the patients were discharged from treatment at the end of that period, the full usefulness of the arm not being obtained in less than twelve months, or even more.

The mortality of this excision is shown by the following tables, which certainly do not justify the remark of Hennen, that it is an operation "more imposing in the closet than applicable in the field."[3]

Primary Operations.

Reporter's Name.	No. of Cases.	No. of Deaths.	Authority.
Larrey,	10	4	Mém. de Chir. Milit., Tom. II. p. 175.
Baudens(Crimea),	11	1	Am. Journ. of Med. Sc., July, 1855, p. 243.
Guthrie,	2	1	On Gun-shot Wounds, p. 468.
Legouest,	6	4	Arch. Gén. de Méd., Avril, 1859, p. 463.
Esmarch,	6	2	Statham's Translation, p. 68.
Macleod,	8	1	Surgery of the Crimean War, p. 328.
Williamson,	1	0	Dublin Quarterly, August, 1859, p. 80.
Stratton,	1	0	Edinb. Med. & Surg. Journ., Jan. 1846, p. 31.
Hello,	1	0	Philad. Med. Exam., Vol. IV. p. 739.
Mann,	3	0	Sketches of the Campaigns of 1812, '13, '14.
Gorré,	1	1	Malgaigne, Tr. des Luxations, p. 558.
Bryce,	2	1	Lancet, Sept. 10, 1830.
Eve,	1	1	Am. Med. Times, July 21, 1860.
	53	16	

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[1] T. Petruschky, De Resectione Articulorum Extremitatis superioris, (Berolini, 1851,) p. 2; Statham's Stromeyer and Esmarch, p. 65; Dublin Quarterly Journal, (Aug., 1859,) p. 81.

[2] P. G. Kyriakos, De Articuli Humeri et Cubiti Resectione, (Berolini, 1854,) p. 6.

[3] Principles of Milit. Surg., 3d ed., (London, 1829,) p. 40.

Secondary Operations.

Reporter's Name.	No. of Cases.	No. of Deaths.	Authority.
Esmarch,	13	5	Statham's Translation, p. 68.
Baudens (Crimea),	3	0	Am. Journ. of Med. Sc., July, 1855, p. 243.
Williamson,	2	0	Dublin Quarterly, August, 1859, p. 81.
Macleod,	5	0	Surgery of the Crimean War, p. 328.
Guthrie,	6	0	On Gun-shot Wounds, p. 468.
Baddely,	1	0	Am. Journ. of Med. Sc., April, 1843, p. 467.
Beith,	1	0	Lancet, February 23, 1856.
Heyfelder,	1	1	Operationslehre, u. s. w., p. 211.
Hancock,	1	0	Lancet, July 6, 1850.
Waters,	1	0	N. Y. Journ. of Med., May, 1847, p. 318.
	34	6	

Uniting these two series of cases, and adding to them six operations with three deaths performed by M. Baudens in Algiers,[1] and three others, successful, (one by Langenbeck and two by Textor,[2]) of which it is unknown whether they were primary or secondary operations, we have a total of 96 cases, with 25 deaths, or a mortality of 26 per cent. Comparing the above result with the statistics of amputation at the shoulder-joint as derived from Crimean experience,[3] from which we learn that, of 60 operations, 19, or 31.6 per cent, were fatal, we have a result in favor of excision of 5.6 per cent.

"It is curious," says Esmarch, "that the operation on the left side seems to give less favorable results than on the right; 6 out of 12 died of those resected on the left, and 1 out of 7 of those resected in the shoulder, on the right side. A similar proportion held good in resection of the elbow; for of those operated upon on the left, 4 in 19, on the right, 2 in 20, resections proved fatal. From this, the fatality attending operations on the left arm to that on the right is as three to one; but," he justly adds, "further observations are required to enable conclusions to be deduced."[4]

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[1] Lond. Med. Gaz., Oct. 20, 1838.

[2] Arch. Gén. de Méd., 5^{me} série, Tom. II. p. 714.

[3] Macleod, *op. cit.*, p. 389.

[4] Statham's Stromeyer and Esmarch, p. 68.

In the cases which I have myself collected, mention is so seldom made of the side injured, whether left or right, that I am unable to add anything in confirmation of or against the preceding statement.

Secondary excisions are not followed by the mortality usually supposed to attend them. Such a conviction had been established in my own mind before I learned that the experience of the surgeons in the Schleswig-Holstein war had led them to the same conclusion. By the preceding tables it appears that in 53 primary operations there were 16 deaths, or a mortality of 30.18 per cent, and in 34 secondary operations 6 deaths, or a mortality of 17.64 per cent, being 12.54 in favor of the latter.

This fact is made particularly apparent by Esmarch, who reports that of 6 excisions of the head of the humerus performed within 24 hours of the injury, 2 died. Of 3 during the inflammatory stage, or on the third or fourth day, 2 died; and of 10 after suppuration was established, 2 died. Of 8 cases suited for excision and which were left to nature, not being operated on, owing to insufficient experience of the value of excision, 5 died, and the remaining 3, at the end of six months, still seemed to need operative interference.[1]

"Of 26 patients in the ambulances of M. Baudens, 11 immediate excisions were performed with 10 recoveries. From their injuries seeming less grave, 15 were treated by expectation; of these, 8 died of purulent infection, 3 underwent consecutive resection with success, and 4 suffered a long train of ill consequences from fistulous openings."[2] Though this is rather negative testimony, still it will be observed that all the secondary operations had a favorable termination. All those, also, which appear in the English Crimean returns were equally successful.[3]

It is probable that the greater success of secondary operations is due to the fact, that it is the less grave injuries which are reserved for expectant treatment; and that after the lapse of time and the establishment of suppuration, the exact extent of the injury, as to fissures, fracture, injury to the periosteum, etc., can be determined in a manner not always easy to effect at the time of the accident. In the one case, all which should be is removed, in the other, the operator may fall short of the proper limits.

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[1] Statham, *loc. cit.*

[2] Am. Journ. of Med. Sc., July, 1855, p. 243.

[3] Macleod, *op. cit.*, p. 331.

EXCISION FOR DISEASE.

Excisions of the shoulder-joint have been performed for caries and necrosis, as well as for malignant and non-malignant tumors or affections, which by their extension, or rapidity of progress, promise either to render any operation impracticable, or require the removal of the limb at the articulation.

Excision for malignant disease is, as might be expected, attended by no encouraging success; perhaps even with less than amputation. Roux removed the head of the humerus for an osteo-sarcoma, and the patient died shortly afterwards.[1] Mr. J. Hutchinson excised the head and upper fifth of the humerus on account of a large myeloid tumor, developed within the bone, and death occurred from recurrent disease in the lungs and elsewhere before the usefulness of the limb had been put to much trial.[2] Another similar operation, by the same surgeon, was equally unsuccessful, the disease recurring and death ensuing from hemorrhage four months after its performance.[3]

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[1] London Med. Gaz., Sept. 13, 1834.

[2] Med. Times and Gaz., Aug. 20, 1859.

[3] Ibid., Nov. 1, 1856.

Mr. Bickersteth, of Liverpool, has successfully excised the head of the humerus for an exostosis.[1]

Upon two occasions Dr. Daniel Brainard, of Chicago, has opened the shoulder-joint for removal of the head of the bone, on account of the suppuration resulting from severe injuries; in one case a year after, and in the other three months after the receipt of the injury. The head of the bone in each instance was loose, necrosed, and partly absorbed or macerated. Both patients recovered with tolerably useful arms.[2] Two somewhat similar instances, where the heads of the bones were spontaneously discharged, the parts rapidly healing, are cited by Blackburn[3] as having occurred to Sabatier.

Schillbach reports the case of a boy, sixteen and a half years old, from whom, at the inner and back part of the head of the humerus, a sequestrum, the size of a quarter-dollar and two and a half lines thick, was removed by enlarging in different directions the fistulæ to which it had given rise. The rest of the joint was healthy, excepting in one other spot, where a small fragment was extracted. After the operation, the infiltration and swelling soon disappeared, and in twenty-five days the patient had full use of the arm.[4]

It is, however, to cases of "white-swelling," where the shoulder-joint becomes disorganized by disease of the synovial membrane, by ulceration of the cartilages, or caries of the bone, that excision is especially applicable.

It is a notable fact, that this articulation is less frequently thus affected than any other of the large joints of the body; according to the records of Guy's Hospital, in only one per cent of all the cases of diseased joints.[5] A rather insufficient explanation of this immunity has been offered by suggesting that the synovial capsule, being covered externally by the very dense and non-vascular tendons of the scapular muscles, is thereby indisposed to propagate and keep up an inflammation.[1] It is also a peculiarity of this joint, that disease ordinarily confines itself to the head of the humerus, without involving the opposite articular surface. In but 17 of the 50 cases of this excision which I have collected, did the glenoid cavity require to be interfered with.

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[1] Lond. and Edinb. Month. Journ. of Med. Sc., June, 1853.

[2] Hamilton, Treatise on Disloc. and Fract., p. 217.

[3] Guy's Hosp. Rep., April, 1836, p. 274.

[4] Beitr. zu den Resect. der Knoch., (Jena, 1859,) p. 130.

[5] Bryant, Dis. and Inj. of Joints, p. 136.

The infrequency of disease of the shoulder-joint is also shown by the comparative infrequency of its excision. The table on pages 34 and 35 comprises all the instances of its performance which a thorough search enables me to find.

Of the 50 cases there enumerated, 34 were males and 12 females, the sex not being stated in 4. In 14 the excision was of the right arm, in 12 of the left, in 24 the side not being stated. In 42 recovery took place, and in 8 there was a fatal result; but two of those classed as recoveries died of phthisis at the end of a year, and two others were not particularly benefited by the operation. It appears, therefore, that 16 per cent of all the cases were fatal, and 24 per cent unsatisfactory in their results. Of the unsuccessful operations, 4 were upon the right arm, 3 upon the left, and in 5 the side is not mentioned.

The deaths occurred at the expiration of 1 year, 6 months, 5 months, 3 months, 6 weeks, 3 weeks, and 2 weeks; in one case the time which elapsed not being stated. Three were from phthisis, two from exhaustion, one from diarrhœa, one from uræmic poisoning, and in one the cause is not reported.

In these eight fatal cases, there is but a single instance of partial excision; with this exception, in every case where death followed, the glenoid cavity had been either gouged, excised, or cauterized. The reason of this exception to a general rule is not apparent, unless it is that, the weight of the arm separating the end of the hume-

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[1] Bonnet, Mal. des. Artic., Tom. II. p. 570.

	Sex.	Age.	Extent of Excision.	Termination.
1	M.	17	R. arm; one third of head of humerus.	Recovered.
2	F.	38	L. arm; head of humerus; end of acromion.	"
3	M.	40	L. arm; head of humerus, coracoid process and glenoid cavity gouged.	Died.
4		5	Head of humerus.	Recovered.
5	M.	13	R. arm; head of humerus.	"
6	F.	46	R. arm; head of humerus. Glenoid cavity gouged.	"
7	F.	25	Large part of head of humerus.	"
8	M.	17	L. arm; head of humerus. Glenoid cavity gouged; subsequently, a piece of the shaft.	"
9	M.	57	R. arm; head of humerus.	"
10	M.	35	L. arm; head of humerus.	"
11	M.	25	Head of humerus. Glenoid cavity gouged.	Died.
12	M.	35	R. arm; head of humerus.	Recovered.
13	F.	27	Head of humerus.	"
14	M.	60	R. arm; head of humerus.	Died.
15	F.		R. arm; head of humerus.	Recovered.
16	M.	40	Head of humerus.	"
17	F.	45	L. arm; head of humerus; external angle of scapula; part of acromion process.	"
18	M.	19	L. arm; head of humerus. Glenoid cavity gouged.	"
19	M.	19	L. arm; head of humerus. Glenoid cavity gouged.	"
20	M.	14	L.arm; head and 5¾ in. of humerus.	"
21	M.	60	Head of humerus and glenoid cavity.	"
22	M.	28	L. arm; head of humerus.	"
23	M.	37	R. arm; head of humerus.	"
24	M.	65	R. arm; head of humerus and glenoid cavity.	Died.
25	M.		Head of humerus.	Recovered.
26	F.	19	R. arm; head of humerus.	"
27	F.		R. arm; head of humerus and glenoid cavity.	Died.
28	M.	34	R. arm; head of humerus.	Recovered.
29	F.		Head of humerus.	"
30	M.	25	Head of humerus.	"
31	F.	29	Head of humerus. Glenoid cavity gouged.	Died.
32	F.	10	Head of humerus.	Recovered.
33	M.	40	Head of humerus.	"
34	M.	24	Head of humerus.	"
35			Head of humerus. Glenoid cavity cauterized.	Died.
36	M.	40	Head and 4 in. of humerus.	Recovered.
37	M.		R. arm; head of humerus.	"
38			Head of humerus.	"
39	M.	39	L. arm; head of humerus. Glenoid cavity gouged.	Died.
40	M.	28	L. arm; head of humerus. Glenoid cavity gouged.	Recovered.
41	M.	13	Head of humerus.	"
42	M.	25	L. arm; head of humerus.	"
43	M.	39	Head of humerus. Glen. cav. and neck of scapula.	"
44	M.	20	Head and upper third of humerus.	"
45	M.	15	Head and upper third of humerus.	"
46	M.	29	Head of humerus.	"
47	M.	5	R. arm; head and 1 in. of shaft. Glen. cav. gouged.	"
48			Head and 4 in of humerus.	"
49	M.	20	Head of humerus. Glenoid cavity gouged.	"
50	F.	18	Head and large portion of shaft of humerus. Glenoid cavity gouged.	"

Length of Treatment.	Ultimate Result.	Authority.
3 mos.	Does duty as a sailor.	Am. Journ. of Med. Sc., Oct. 1846.
2 mos.	Sews, knits, washes.	Syme, Excis. of Dis. Joints, p. 51.
6 mos.	Death from phthisis.	Ibid., p. 58.
2 mos.	"Pretty good use of limb."	Am. Journ. of Med. Sc., Oct. 1857.
6 weeks.	Useful arm.	Dict. des Sc. Méd., T. 47, Résection.
5 weeks.	Very useful arm.	Med. Times & Gaz., Nov. 26, 1859, *and* Lancet, Feb. 25, 1860.
	"Complete use of the arm."	Fergusson's Pr. Surg., 3d ed., p. 308.
1 year.	"Extremely useful arm."	Lancet, Dec. 11, 1852, *and* Erichsen's Sc. and Art of Surg., 3d ed., p. 702.
18 mos.	Works as a farm-laborer.	Lancet, Aug. 25, 1855, & M. Chir. Tr., [Vol. 42.
8½ mos.	Very useful arm.	Lancet, Mar. 4, 1854.
6 weeks.	Death from uræmic pois'ng.	Med. Times and Gaz., Mar. 31, 1855.
10 mos.	Very useful arm.	Lancet, Mar. 8, 1851.
2 mos.	Useful arm.	Ibid., Mar. 4, 1854.
2 weeks.	Death from diarrhœa.	Lancet. Sept. 12, 1857.
9 weeks.	Very useful arm.	Philos. Trans. Lond., Vol. 64, p. 353.
3 mos.	Not a very useful arm.	Ibid., Vol. 69, p. 6.
4 mos.	Useful arm.	Jeffray's Park and Moreau, p. 162.
4 mos.	Useful arm.	Lancet, Feb. 25, 1860.
6 mos.	"Not relieved."	Mass. Gen. Hosp. Records.
3 mos.	Tolerably useful arm.	Med. News and Library, Aug. 1851.
3 mos.	Weaves ten hours a day.	Bost. Soc. for Med. Imp., Vol. I. p. 335.
2 mos.	Beginning to use the arm.	Philad. Med. Ex., Vol. IV. p. 306.
25 days.	Died of phthis. at end of a yr.	J. F. Heyfelder, ueber Resect., p. 131.
21 days.	Death from exhaustion.	Ibid., p. 133.
8 mos.	Died of phthis. at end of a yr.	New Sydenham Soc., Vol. V. p. 229.
	Moves arm in all directions.	Lancet, Mar. 22, 1856.
5 mos.	Death from phthisis.	Med. Times and Gaz., Feb. 4, 1860.
9 mos.	Very useful arm.	Med.-Chir. Trans., Vol. 42, p. 1.
	Some motion; fore arm very useful. Died of phthisis 5 years after operation.	Trans. of N. H. Med. Soc., 1859, p. 47.
	Fair amount of motion.	Med. Times and Gaz., May 8, 1858.
3 mos.	Death from phthisis.	Ibid.
	Useful arm.	Ibid., Aug. 1, 1857.
	Useful arm.	Ibid.
6 weeks.	No details.	Ibid., Aug. 20, 1859.
	No details.	Blackman's Velpeau, Vol. II. p. 474.
	Most satisfactory result.	Gross. Syst. of Surg, Vol. II. p. 1087.
1 month.	Very useful arm.	Arch. Gén. de Méd., [2.] T. 5, p. 156.
	Most of the motions preserved.	Brit. & For. Med. Chir. Rev., Apr. 1851, p. 299.
1 year.	Caries and exhaustion.	Schillbach, Resect. der Knochen, p. 141.
3 mos.	Movements tolerable.	Ibid., p. 149.
10 weeks.	No details.	Glasgow Med. Journ., Oct., 1856.
4 mos.	"As good use as ever."	N. Orleans M. and S. Journ., Jan. 1861.
3 mos.	Useful arm.	Lond. Med. Gaz., Aug. 1845.
14 days.	In a year did heavy manual labor.	N. Am. Med.-Chir. Rev., May, 1858, p. 557.
14 days.	Works as a farm-laborer.	Ibid.
3 weeks.	Useful arm.	Ibid.
2 mos.	Useful arm.	Western Lancet, Aug. 1857, p. 551.
	Excellent result.	O. Heyfelder, Operationslehre, p. 221.
	Considerable range of motion obtained.	Med. Times and Gaz., Apr. 27, 1861.
	No details.	Ibid.

rus from the glenoid cavity, union by apposition does not take place, as in most excisions, and the incongruous *rapprochement* of a cartilaginous and osseous surface, which seems to be one of the chief difficulties in other partial operations, is thus prevented. That the train of consequences usually to be feared under such circumstances may occur, seems to be shown by the remarks of Dr. Crosby, of Manchester, N. H., in the report of a case operated on by him, and where two or three openings continued to discharge during the five years which the patient survived. "It may be asked," he observes, "why the wound did not entirely heal; I can only say, that it is possible that the articulating surface of the scapula had become diseased after the operation, although it appeared perfectly sound at the time."[1]

The youngest subject of the operation in the foregoing table was 5 (2 cases), and the oldest 65 years of age. The first two lived, both regaining tolerably useful limbs; the last died of exhaustion at the expiration of three weeks. The average age of those who recovered, where this is stated, is $27\frac{35}{36}$ years, of those who died, 43 years.

With regard to those cases in which recovery took place, it may be said that, apart from the preservation of the hand and fore-arm, no excision leaves so satisfactory results with so little danger to life and so little demand for that constant supervision which other excisions require. The occurrence of anchylosis is extremely rare, and when it does happen, as has been already stated, it is compensated for by the mobility of the scapula. Guthrie relates a case where it took place, and yet the limb retained so much motion, "from the range of the scapula, as to enable the patient to put on and take off his clothes, tie his handkerchief, use his knife and fork, and perform many other operations of comfort and convenience."[2] The articulation usually becomes a sort of ginglymoid, instead of an enarthrodial one, rotation being lost by the division of the muscles inserted into the tuberosities of the humerus. The limb has a certain swing or pendulum-like motion, and the power of lifting it from the side is limited. Dr. Paul F. Eve reports a case where, in six months after an excision for gun-shot injury, the arm could be raised to a level with the clavicle,[1] but the extent to which it can usually be lifted seldom exceeds five to eight inches. The movements of the hand and fore-arm are rarely impaired. A certain amount of shortening always ensues. The greatest removal of bone in any case appears to have been 5¾ inches (No. 20), and this was done without by any means destroying the usefulness of the limb; for, though the movements of the scapula were lost, those of the fore-arm and hand remained intact. Mr. Bent's patient (No. 15) was able to sew, knit, and dress herself; others resumed their occupation, such as that of engineers, farm-laborers, weavers, sailors, etc., and the frequent report (evincing perhaps more enthusiasm than careful observation) is, that all the necessary movements of the limb, which do not require too great an elevation of the elbow, are performed with the same facility as by that of the opposite side.

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[1] Trans. of the New Hampshire Med. Soc., 1859, p. 47.

[2] On Gun-shot Wounds, p. 476.

It is impossible to compare these results with those of amputation at the shoulder-joint, the performance of which for non-malignant disease is of rare occurrence. The advantage, however, does not lie in any diminution of the danger, for the mortality is probably about the same, — disarticulation not being a very fatal operation, — but in the preservation of a limb retaining more or less of its usefulness.

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[1] Nashville Journ. of Med. and Surg., July, 1860.

OPERATION AND AFTER-TREATMENT.

A GREAT variety of methods of performing the operation of excision of the head of the humerus, or of the whole articulation, have been described. Formal incisions will, however, often be modified by the sinuses and fistulæ, or wounds of the soft parts, if the case be a traumatic one, which may already exist.

When applicable, the operation practised by Baudens[1] is unquestionably the preferable one, on account of its simplicity, and because it obviates dividing the fibres of, and cicatricial deposits in, the deltoid muscle, though these perhaps are minor considerations.

A straight incision, commencing as high as the acromion and just external to the coracoid process, where it can be carried higher than elsewhere, the point of the knife penetrating to, and keeping in contact with, the bone, is prolonged downwards along the anterior aspect of the joint, the head of the bone being more superficial at this than at any other part. The incision thus made corresponds to the bicipital groove containing the long head of the biceps muscle, which, according to Langenbeck, it is desirable to preserve undivided, whenever possible.[2] This tendon being held to one side, the groove serves as a guide to the insertion of the four muscles attached to the tuberosities of the head of the humerus. Rotation outward, putting it upon the stretch, permits the division of the tendon of the internal muscle, and rotation inward exposes and allows the easy section of those belonging to the external muscles. The section of these opens the capsule which, in a great measure, they form. The head may then be tilted from its socket, and the bone sawed across.

Thickening and induration of the soft parts by disease may, however, prevent the articulating surface from being made accessible without prolonging a straight incision to too great an extent, even though the fibres of the deltoid be divided transversely on each side without including the integument, as Baudens suggests. If, therefore, some different method must be selected, the formation of a crescent-shaped flap, as in the exarticulation called "Dupuytren's," will be found as advantageous as any other of the numerous incisions which might be described.

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[1] Trans. of Memoir in Am. Journ. of Med. Sc., July, 1855, p. 242.

[2] Petruschky, *op. cit.*, p. 23.

It is always desirable to cut off the head of the humerus within the capsule, not only to diminish the amount of shortening necessarily ensuing, but that the posterior circumflex artery, a vessel of large size, and the circumflex nerve, both of which pass close to and just below the head of the bone to be distributed in the deltoid muscle, may be respected. Whatever mode of operating is adopted, however, and whether or not these are divided, the deltoid is sure to become atrophied after the operation, if it has not already become so through disuse, or by the unhealthy condition developed in the soft parts.

The section of the bone may be made by the chain-saw or the common saw, the soft parts being protected by a spatula passed behind it. In cases of fracture of the neck, and where the head cannot be turned out of its place, nor be rotated as directed above, it must be seized by strong forceps and removed as we best may. In such cases it is not necessary to do more than cut off the sharp edges and irregularities of the shaft of the bone. It is to be remembered that the shaft of the humerus, when in an unhealthy state, may be easily broken by the operator in tilting the head outwards. An accident of this kind occurring to so skilful and experienced an operator as Mr. Stanley of St. Bartholomew's, is sufficient evidence of the necessity for being forewarned of its liability to happen.

The glenoid cavity, if diseased, may be cut away with the bone forceps, or gouged, as the case may require. The acromion and coracoid processes, though not entering into the formation of the shoulder-joint, sometimes participate in the disease, and then require removal like other parts concerned. In the present state of surgical science, the application of the actual cautery for the cure of caries unremoved by the operation cannot be considered as a judicious measure.

Allusion has been made to a recommendation, that division of the long tendon of the biceps muscle should be avoided. The preservation of this tendon is not probably a point of any great importance, unless in excisions for a traumatic cause, when it may generally be saved without difficulty, and perhaps with advantage. The experiments of Wagner, who excised the head of the humerus in forty-five rabbits, led him to attach very considerable importance to its preservation.[1] In disease it is usually destroyed, or at all events rarely seen during the operation,[2] and Esmarch, although strongly advocating its preservation, remarks, that the unimportance of the step "was shown in three cases where the tendon had been torn across by the ball, yet, on the cure being completed, the patients very soon obtained free and voluntary use of the arm."[3]

Mr. Fergusson reports a single case in which he gouged out the carious head of the humerus through a simple opening made in the capsular ligament, and the patient regained "complete use of the arm." "The proceeding," he says, "was entirely novel in its character."[4] But the Chevalier Bernardino Larghi, of Turin, had already, in February, 1848, performed several operations of the sort, and cites Blandin as having imitated his example.[5]

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[1] On the Process of Repair after Resection, &c. New Syd. Soc., Vol. V. p. 168.

[2] Med. Times and Gaz., Nov. 5, 1859.

[3] Statham's Stromeyer and Esmarch, p. 67.

[4] Pract. Surg., 3d ed., (Lond.,) p. 308.

[5] Giornale delle Scienze Mediche di Torino. Ranking's Abstr., 1848, p. 118.

More recently, M. Sédillot, of Strasbourg, has proposed as his own this very operation of scooping out the diseased extremities of bones (*évidement des os*) in place of excising them, in order, as was the object of his predecessors, to preserve the periosteum. On the 31st of October, 1859, he brought to the notice of the French Academy of Sciences ten cases thus operated on, of which three had died, one of phlegmonous erysipelas, the others at the end of several months, from causes, as he states, "in no way connected with the method pursued." Most of the patients had been subsequently seen, and found to be in a very satisfactory condition.[1] These operations included cases where the condyles of the femur and the head of the tibia were thus gouged out, and the external surface of the bone left intact. Two additional successful cases are reported by Messrs. Marmy of Lyons, and Ehrmann of Constantine.[2]

If the difficulties in the way of exact diagnosis, as well as the usual condition of joints which justify operation, are remembered, it will be seen that the cases to which this method can be made applicable must be of rare occurrence. Moreover, it would seem that M. Sédillot's confidence in his new method has been short-lived, since in the Lancet of August 24, 1861, we find him virtually condemning it on account of its frequent liability to failure; suppuration, according to his experience, destroying the bone-making function of the periosteum.

The treatment subsequent to the operation of excising the shoulder-joint is of the simplest character, and hardly requires any formal description. Nothing should be done to restrain motion, further than is necessary to prevent irritation or displacement. The tendency of the pectoralis and teres major and of the latissimus dorsi to draw the extremity of the humerus inward, is to be prevented by a cushion in the axilla. Besides this, repose, with the shoulder and arm supported on a pillow for the first few days, and subsequently a sling and gentle compression with a bandage, to facilitate the discharge of matter, or to prevent it from burrowing down the arm, and the earliest use of passive motion, constitute nearly all which can be required.

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[1] Arch. Gén. de Méd., Dec. 1859, p. 748.

[2] L'Union Médicale, Nov. 29, 1859, p. 425.

The wound is generally very nearly healed at the end of a few weeks, but one or more sinuses sometimes continue discharging for months, or even a year, and small portions of bone occasionally come away, but without hindrance to the regaining of a useful limb.

The average length of time before some use of the limb was commenced, as calculated from 31 of the cases in my table in which the period is stated, was $111\frac{29}{31}$ days, or over four months; a much longer period than this was required, however, to elapse before it could be said to have become really serviceable.

As an example of rapid recovery, and for the characteristic style of the narrative, the following account may be quoted from an article by Percy and Laurent. "L'un de nous fournit en 1789 un bel exemple de l'ablation de la tête de l'humerus, à l'Académie Royale de Chirurgie, à l'une des séances de laquelle il présenta un petit garçon de treize ans, lequel, tenant de sa main droite la tête de son humerus du même côté qu'elle lui avait enlevée *six semaines* auparavant par le chirurgien major du régiment de Berri, cavalerie, en fit homàge à la compagnie, que la conduite et l'esprit naturel de cet enfant interessaient presque autant que la piece, quoique tres râre, dont il faisait don."[1]

According to Larrey, the chances of anchylosis are in proportion to the rapidity of cure. The early use of passive motion and the observance of hygienic rules will lead, with more rapidity than in most instances of the excision of joints, to a successful result, without exposing to the risk of the accident just mentioned. Anchylosis is said not to have occurred in a single instance after the numerous operations of the Schleswig-Holstein war.[1]

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[1] Dict. des Sc. Méd., Art. *Humerus.*

DISSECTIONS.

In five dissections of the parts involved in this excision, three of which had been performed for caries, and two for accident, the patients having survived the operation 6 months, 6, 10, 11, and 19 years, the functions of the arm being in all regained, anything resembling a capsular ligament was found only in one case; the end of the humerus was sometimes rounded and sometimes surmounted by processes, into which the muscles were inserted in a confused mass. A deposit of fibro-cartilaginous or fibrous matter between the end of the humerus and the scapula united the former by ligamentous bands to the acromion and coracoid processes and edges of the glenoid cavity, and by this the mobility of the limb was secured.[2]

In a remarkable case reported by Chaussier, where the head of the humerus, being carious, was eliminated by natural processes, the opposing portion of the scapula formed a rounded head, which was received into a cavity hollowed out in the end of the humerus.[3]

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[1] Statham's Stromeyer and Esmarch, p. 65.

[2] Wagner, On the Process of Repair after Resection, etc., New Syd. Soc., Vol. V. p. 118.

[3] Magasin Encyclopédique, Vol. XXX. p. 521.

CONCLUSIONS.

THE conclusions which may be arrived at with regard to excision of the shoulder-joint are as follows: —

First, That the earliest authenticated instance of the operation is a decapitation of the head of the humerus reported by Mr. James Bent, of Newcastle, England, and performed in October, 1771; the first complete excision having been by Moreau in July, 1786.

Second, That when performed for traumatic cause it is fatal once in every $3\frac{21}{25}$ cases; secondary excision being more successful than primary in the proportion of 17 to 10.

Third, That it is not a justifiable operation in cases of malignant disease of or about the shoulder-joint.

Fourth, That excision or abstraction of the necrosed head of the humerus is almost uniformly successful.

Fifth, That it is fatal once in every $6\frac{1}{4}$, and fatal or unsuccessful once in every $4\frac{1}{6}$ cases of its performance for white swelling.

Sixth, That the ultimate results of all excisions of this joint, whether for injury or for disease, are very satisfactory, anchylosis being of exceptional occurrence.

Seventh, That *partial* excision is not usually followed by the accidents which so often succeed it when done in the ginglymoid joints; on the contrary, interference with the glenoid cavity seems materially to increase the dangers of the operation.

ELBOW-JOINT.

HISTORY.

The case of Mr. Wainman, of Shripton, England, in which he sawed off the lower end of the humerus, just above the olecranon fossa, in a case of compound dislocation, is famous in the history of excisions for its very early date. The patient lived, and the limb was as flexible "as if nothing had ever been amiss." The meagre details of this operation were first published in Henry Park's letter to Mr. Pott, dated September 18, 1782, and it is spoken of as having been performed "twenty-three years before"; but whether before the date just named, or that of the excision of the knee (July 2, 1781), which is the subject of the letter, is not stated. Mr. Wainman must, therefore, have operated either in 1758 or 1759.

The letter alluded to, and in which also Mr. Park formally proposed excision of the elbow, though he had not performed it himself, except upon the dead subject, elicited the fact that Mr. Justamond, of London, in 1775, had excised the olecranon and two inches of the ulna for disease, and that Mr. Tyre, of Gloucester, had cut off two and a half inches of the lower end of the humerus after a compound dislocation.[1] These partial excisions are the earliest ones which were practised upon the elbow-joint.

The elder Moreau claims to have submitted to the French Academy in 1782 (the same year in which Park suggested it) a proposition to excise this joint. This was before he could have heard of Park's letter, which was not translated by Lassus until 1784. He did not operate, however, until 1794, when he performed the first complete excision of the elbow of which any mention is made. In June, 1797, the operation was performed by his son.[1]

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[1] Lond. Med. Journ., Vol. XI. p. 282.

Mazozza, of Milan, Sommeillier, Percy, and Champion, in France, are also mentioned as early operators, but the details of their cases are nowhere given.[2] Roux, who subsequently became one of its strongest advocates, operated for the first time in 1819.[3]

In 1817 or 1818, the elbow was completely excised for the first time for disease in England by Mr. Josiah Stansfield, of Leeds, and in 1819 the operation was a recognized one in the Infirmary of that town, having been performed by two others of its surgeons, Messrs. Chorley and Hey.[4] In February, 1823, the elbow was excised in Dublin by Sir (then Mr.) Philip Crampton,[5] and in 1828, by Mr. James Syme in Edinburgh. The latter was so pleased with his success, that he declared that "carious joints might be cut into with the same impunity as ordinary abscesses, and cut out with no more danger than what attends amputation, or rather not so much, since the balance of action will be less disturbed, *cæteris paribus*, when the limb is allowed to remain."[6] In 1831, this distinguished surgeon published a memoir on the "excision of diseased joints," containing the records of 17 cases of elbow-excision, 14 of which were his own. From this period onwards, the annals of surgery furnish abundant examples, the gentleman just named having himself, in 1855, operated "more than one hundred times."[7]

In the United States, the elbow was first excised by Dr. John C. Warren, of Boston, October 16, 1834.[8] The case was communicated verbally to Velpeau, who alludes to it in his *Médicine Opératoire*,[1] but was never otherwise published. June 5, 1835, the operation was repeated by the late Dr. Thomas Harris, of the U. S. Navy;[2] afterwards by Dr. Buck, of New York, in 1841, and by Dr. Pancoast, of Philadelphia, in 1842.[3]

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[1] Jeffray's Park and Moreau, pp. 82, 96, 110.

[2] Dict. des Sc. Méd., Dict. en 30 Vol., Velpeau.

[3] Blackman's Velpeau, Vol. II p. 455.

[4] Lancet, Mar. 17, 1855.

[5] Dublin Hosp. Reports, Vol. IV. p. 191.

[6] Edinb. Med. and Surg. Journ., April, 1829.

[7] Lancet, Mar. 3, 1855.

[8] Mass. Gen. Hosp. Records.

Baron Larrey urged this excision upon his surgeons, but it does not appear that his advice was followed, for Percy says, that "timidity, carelessness, routine, and indifference too often led them to prefer amputation, even under the very eyes of the old chieftain of military surgery."[4] Mr. Alcock, in his paper already referred to, writing in 1840, says: "Of the total excision of the articulating ends of the elbow-joint, I find no instance in the annals of either British or French military surgery."[5] Wachter,[6] however, cites from Bilguer, who wrote in 1781, three cases in which fragments, comprising in one instance the whole elbow-joint, in another the ends of the humerus and ulna, and in the third those of the ulna and radius, were removed, and which at the end of several months recovered without anchylosis. It is mentioned also by both Jaeger and Tobold, that a German named Gröcke, in 1793, performed a partial excision of the elbow for a gun-shot wound; the patient, a soldier, recovering at the end of five months with an anchylosed joint.[7]

But it was not till the Schleswig-Holstein war of 1848–1851, that this excision was really introduced and popularized in military practice, chiefly, as is generally admitted, through the exertions of B. Langenbeck of Berlin and L. Stromeyer of Erlangen, Surgeons-in-Chief of the above-named campaign.[8]

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[1] Blackman's Velpeau, Vol. II. p. 485.

[2] Am. Journ. of Med. Sc., Vol. XIX. p. 341.

[3] Philad. Med. Exam., Sept. 17, 1842.

[4] Dict. des Sc. Méd., Vol. XLVII., Art. *Résection.*

[5] Med. Chir. Trans., Vol. XXIII. p. 254.

[6] De Artic. Extirp., p. 17.

[7] Op. Resect. Consp. chron. Adumb., p. 6. De Artic. Cubiti Resect., p. 8.

[8] Statham, Macleod, Petruschky, etc., etc.

Excision of the elbow-joint has been performed for injuries, for disease, and for anchylosis, this being one of the two joints in the body to which, for the last-named cause, the operation has been considered applicable.

EXCISION FOR INJURY.

The elbow is the frequent seat of compound fracture and dislocation from various causes, and in battle its exposed position in both loading and firing makes it constantly liable to gun-shot injuries.

For such accidents, met with in civil practice, as from their extent or severity require excision of the elbow, the operation has been performed with much success, the position of the patient afterwards, and the general character of the injuries, as compared with those occurring in military practice, simplifying considerably the choice between it and amputation.

In a paper by Mr. Jonathan Hutchinson,[1] the conclusions drawn from a series of 12 cases of severe injury of the elbow-joint, variously treated, are, that primary amputation ought never to be thought of, unless either the artery be torn through, or the soft parts in front as well as behind; that it is far better surgery to excise the ends of the bones, than to be content with simple reduction; that cases with the smallest opening in the integuments are generally the most serious; that less suppuration and less constitutional disturbance appear to follow, and the chances of good motion are infinitely greater after excision, than when the injured ends of the bones are allowed to remain.

The success which attends the operation in civil hospitals and private practice is quite remarkable. Of 21 cases, the facts of which are in my possession, but a single one resulted fatally, and then from causes in no way attributable to the excision. In all the others a rapid recovery ensued, leaving a limb of variable serviceableness, but vastly better than none, or than any artificial substitute. A greater number of facts, it is believed, would only confirm these results. As compared with amputation, the contrast as to mortality is strikingly in favor of excision, since of 13 amputations of the upper extremity for traumatic cause, performed in Guy's Hospital, 23 per cent, or 1 in 4.33 of primary, and 20 per cent, or 1 in 5 of secondary operations, proved fatal.[1]

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[1] Med. Times and Gazette, July 12, 1856.

It may be a question whether the operation is as properly applicable to compound dislocations, uncomplicated with fracture, as to compound and comminuted fractures. This point is not brought out by the cases above referred to, and I am not in possession of facts to illustrate it. The opinions of Dr. Hamilton (p. 5) and of Mr. Hutchinson are, however, strongly in favor of it, and the error, it seems to me, is liable to be rather on the side of reduction than on that of the operation.

The greater extent to which gun-shot wounds are apt, as a rule, to involve the soft parts with the large vessels and nerves, or to splinter the bones, to say nothing of the unpropitious conditions for subsequent care in which the patient is placed by the exigencies of a campaign, must often render the choice of operation difficult and embarrassing; far more so than in injuries of the shoulder, a joint which can, by its anatomical position, even under adverse circumstances, be kept tolerably immovable, and, consequently, free from many sources of after trouble, with much greater ease than the elbow. Either for this reason, or some other, injuries of the joint of the elbow less frequently do well after gun-shot wounds than those of the

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[1] Med. Chir. Trans., Vol. XLII. p. 71.

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shoulder. Larrey noticed how often tetanus followed them, and every surgeon is aware of their gravity.

The diagnosis of gun-shot wounds of this joint, with reference to the extent of the injury, is not always easy; and it has been observed that in fractures (gun-shot) of the humerus just above the joint, fissures extend downward oftener than upward; and the apparently trivial accident of a fissure into a joint, although not necessarily followed by serious results, is nevertheless frequently succeeded by the most disastrous consequences.[1]

When left to nature, the track of a ball which passes near the joint, as well as the joint itself, usually becomes carious, and ultimately requires excision. "I have seen," says Macleod, "several cases in which, after being traversed by a ball, attempts have been made to save the elbow without excising it, but such trials were anything but encouraging. The motion of the joint and its consequent use will be found much greater after excision than when the arm has been saved without such an operation."[2]

The approval of and growing confidence in this operation is shown by the fact, that in the Schleswig-Holstein campaign, for simple shattering of the elbow-joint by bullets, without other complication, six amputations were performed in 1848, three in 1849, and none in 1850, excisions having taken their place. Of 40 instances of the latter, during the years just named, 6 only were fatal. In one case, amputation, on account of gangrene, was subsequently performed, and one was still under treatment. The remaining 32 resulted in a more or less useful arm. In 8, the general flexibility and mobility at the elbow were very extensive; in 9, tolerably so. In 13, more or less complete anchylosis took place, and of 2 the ultimate issue was not known. The frequency with which anchylosis occurred was attributed to the fact that a large number of the patients were treated after the excision by Danish surgeons, who, having never practised the operation, were ignorant of the importance of timely passive motion, and entirely neglected it.

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[1] Macleod, Surgery of the Crimean War, p. 308.

[2] Ibid., p. 327.

In amputations of the arm, performed during the above campaign, 19 out of 54 were fatal.[1]

In the Crimean war, 22 excisions of the elbow were performed, of which 3 ended fatally; 2 deaths also occurred after secondary amputation.[2] Of 153 arm amputations, 29 were fatal.[3] Of 33 primary disarticulations of the elbow 28 were fatal, and 24 of 31 secondary disarticulations.[4]

Grouping these cases, we have, excluding the one under treatment and that in which subsequent amputation was performed, 60 excisions with 11 unfavorable results, or a mortality of 18.33 per cent, and, adding the one excluded above, 208 amputations with 48 deaths, or a mortality of 23.07 per cent. This gives a percentage of 4.74 in favor of excision. The mortality of disarticulation, it will be observed, has a much greater rate than either.

In cases not thought to require excision at the outset, secondary excision at the end of a week ought not, it would seem, to modify the result. If the objection to meddling with inflamed joints is without any definite reason, the relief which, it is said,[5] follows incisions into them under such circumstances, would probably be increased by the removal of the injured bone and cartilage. Such is the opinion of Stromeyer, who observes that, "as regards the results, it is of no consequence whether the resection is performed in the first forty-eight hours, or after the full development of suppuration."[6] This is further shown by the statistics of Esmarch, according to which, of 11 excisions within the first twenty-four hours of the injury, one died; of 20 performed during the inflammatory stage, that is, from the second to the fourth day, 4 died. Of 9 secondary excisions performed from the eighth to the thirty-seventh day, only one died.[1]

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[1] Statham, *op. cit.*, pp. 79, 86, 87.

[2] Dublin Quarterly, Aug. 1859, p. 85.

[3] Med. Times and Gazette, Sept. 13 and 20, 1856.

[4] Ibid., June 9, 1860.

[5] Lancet, Nov. 22, 1851.

[6] Statham, *op. cit.*, p. 25.

The Crimean war taught that "partial excisions, of which there were a good many cases, did not turn out, on the whole, at all so well as complete ones. They were more tedious, more liable to fail, and less satisfactory when they succeeded, than when the whole articulation was removed."[2] Esmarch disapproves of partial excision, and thinks "that the extensive severing of the ligamentous apparatus of the joint is what deprives the wound of its danger; the less there is removed from the joint-ends of the bones, the greater is the probability of anchylosis."[3] On the other hand, Stromeyer rather advocates the practice, "because experience teaches that anchylosis of the arm in an obtuse angle does not interfere much with its use."[4]

In but 7 of the 21 cases of excision for injury, to which reference has been made, occurring in civil practice, was partial excision performed; three were followed by good results; one resulted in partial anchylosis; in one the elbow could not be perfectly extended; in one the unsatisfactory result was attributed to habits of intemperance; and of one we have no special account.

Even if a satisfactory conclusion cannot be arrived at from these data, there is no reason to suppose that this articulation offers any exception to the general rule with respect to the point at issue.

A single remark may be made with regard to treatment, and that is, that poultices are decidedly prejudicial applications in the class of cases which have just been discussed, adhesive processes being prevented by their use, and suppuration and ulceration being excited. Such is the opinion of Guthrie,[1] Sir Astley Cooper,[2] and of Mr. Hutchinson, in his paper already alluded to. My own observation is confirmatory of this conclusion. Their omission is, however, a matter of difficulty, so agreeable are they to the patient; their long employment should at least be prevented, and their use discontinued as soon as possible.

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[1] Statham, *op. cit.*, p. 87.

[2] Macleod, *op. cit.*, p. 336.

[3] Statham, *op. cit.*, p. 79.

[4] Ibid., p. 25.

EXCISION FOR ANCHYLOSIS.

Dr. John Rea Barton, of Philadelphia, in 1827, recommended removal of the ends of the bones of the elbow-joint as a means of curing anchylosis,[3] though an operation done by Textor in 1823[4] may perhaps have anticipated his suggestions. Of late years many surgeons have put in practice this method of treatment.

Mr. Fergusson operated on a man thirty-four years old, for anchylosis of the elbow from unreduced dislocation of seven years' standing, and at the end of three months there was a limited amount of motion.[5] In another case, where a man aged thirty had dislocated the ulna backward and the radius forward, and anchylosis had followed, excision was performed ten months afterwards, viz. June 7, 1856. Passive motion was commenced June 18th. September 25th there was some pronation and supination, and the hand could be brought up to the whiskers. In November the patient was discharged, with a good degree of motion.[6]

Mr. Holthouse operated on the right elbow of a female aged twenty-one, both of whose arms were anchylosed from rheumatism, removing a flat plate of bone. Nearly the natural range of movement was regained, and with little prospect of subsequent impairment.[1]

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[1] On Gun-shot Wounds, p. 66.

[2] On Dislocations and Fractures, p. 414.

[3] North Am. Med. and Surg. Journ., April, 1827.

[4] A. M. Thore, De la Résection de la Coude, (Paris, 1843,) p. 36.

[5] Med. Times and Gaz., Jan. 15, 1853.

[6] Lancet, Oct. 4, 1856.

Mr. Syme operated on a young man, both of whose arms were permanently extended, one from dislocation, the other from fracture and dislocation. One elbow was immovable, the other had slight motion. Excision gave a result "so perfect, that the arm could not be distinguished from a sound one till the sleeve was removed."[2]

Two cases in which the arms were fixed in a straight position are referred to by Mr. Bickersteth, of Liverpool. Unable even to feed themselves, these unfortunate individuals were entirely dependent on the assistance of others. In each case the right elbow was excised, and the limb rendered useful and movable.[3]

A partial excision of the elbow for anchylosis, resulting only in an improved position, is reported by Dr. G. Buck of New York.[4]

Other cases in large numbers might be cited, but these are sufficient to give an idea of the circumstances thought to require, and the results likely to follow, the operation.

The condition of the parts in the neighborhood of unreduced dislocations and badly treated or united fractures, the enlargement of the bones and their interlocking, often render excision of their ends an operation of difficulty. Such was the case in the first of Mr. Fergusson's operations alluded to. And if the bones are not excised so freely as to leave a considerable interval between them, the tendency to reunion will be so great as to be with difficulty overcome.

Although success is frequent, still, considering its uncertainties, the operation, it seems to me, can hardly be undertaken with propriety, except in cases w[illegible] the arm has stiffened either in a straight position, or in one of extreme flexion; or unless some special circumstances in an individual's position authorize an experiment, the results of which may be only a renewed anchylosis.

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[1] Lancet, Oct. 4, 1856.

[2] Ibid., Mar. 3, 1855.

[3] Liverpool Med. Chir. Journ., July, 1857, p. [illegible]

[4] Am. Journ. of Med. Sc., April, 1843, p. 2[illegible]

EXCISION FOR DISEASE.

THIRTY years ago, in all incurable diseases of the elbow, the necessity of amputation was considered inevitable. Now, no excision has been so frequently performed as that of this joint, or with such generally successful results, and no capital operation has a more fixed and recognized position in surgery. At Guy's Hospital, for instance, amputation for disease of the elbow is so rare, that in five years but a single instance of it had occurred, though in the same period eight excisions were performed, with one death and one subsequent amputation; in the remainder, a good arm being preserved.[1]

But little need be added to what has already been said as to the conditions requiring excision. Although Lebert says it has been successfully applied for malignant disease,[2] I have met with no published instance of its performance. Ulceration of the cartilages and caries of the ends of the bones — "white-swelling" in its varying forms — is almost the only affection for which excision of the elbow is ever contemplated. Its frequency in this joint, in the hospital just now mentioned, is as one to four of the hip and knee, which are the most often diseased.[3]

In cases suggesting excision, the existence of a certain amount of constitutional vigor and the failure of patient waiting for a cure by Nature must be ascertained facts, as well as that the disease has reached an incurable state, either from utter want of all rational remedial means, or through their inability to arrest its progress. That such a point has been attained, the eye and the hand of the surgeon can decide better than words describe. There is one feature, however, to which Mr. Fergusson calls such special attention that I cannot pass it by. This is, to quote his own words, "an elasticity about the joint which can be appreciated by pressing the ulna against the end of the humerus, as also by swinging the fore-arm laterally. If there is much mobility and elasticity under such movements, I consider the joint as most seriously involved, and that in all probability the best treatment will be excision, for, when the above condition is present, I believe all hope of cure for years to come may be set aside."[1]

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[1] Bryant, Dis. and Inj. of Joints, (Lond. 1859,) p. 136.

[2] Maladies Cancéreuses, (Paris, 1851,) p. 731.

[3] Bryant, *loc. cit.*

Within certain limits the extent of the disease is not a hindrance to the performance of the operation. That the roughened and stalactitic state to which the shafts of the bones in the vicinity of a diseased elbow are particularly prone, resulting from contiguity to the centre of morbid action, is not an objection to excision, is most satisfactorily answered by the success with which it is performed. It is a condition very different from caries itself, and the result of a process tending to limit rather than increase the disease. Although sometimes requiring removal, the outgrowth usually disappears when the source of irritation is taken away, just as the thickened and indurated tissues surrounding the joint soften down and are replaced under a healthier action.

The condition of the soft parts is in fact a more important point than that just considered; for if it is such that they can only slowly assume a healthy state, it may lead to a return of the disease of the bones. Two cases, where the disease of the integument persisted after the operation and the caries reappeared, are mentioned by Dupuytren as terminating finally in amputation, and a similar instance is cited by M. Thore; within a month of the excision the soft parts had relapsed into a most unhealthy state, and seven or eight months afterward the patient died. Upon one occasion M. Roux thought it necessary to cut the soft parts away largely, on account of their diseased condition, and trust to the slow processes of granulation for their restoration.

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[1] Syst. of Pract. Surg., (4th ed., Lond.,) p. 297.

The histories of collected cases show that the sources of failure lie chiefly in the patient's general condition and tendencies; that the cases demanding subsequent amputation are few in proportion to the whole number of operations, and that death rarely occurs from causes connected with the excision itself.

In 1831 Mr. Syme said: "I have cut out 14 elbow-joints, and the operation has been performed in Edinburgh three times by other practitioners; of all these 17 cases, only two have terminated fatally, and in one of them the patient would, I believe, have died from any operation whatever; while in the other, the disease was found so extensive as to render the excision almost impracticable. I believe that the result of 17 amputations in similarly unfavorable constitutions would not be so satisfactory."[1]

Mr. Bickersteth, of Liverpool, operated on 19 patients, and only 2 died from the operation; one, of delirium tremens on the twenty-sixth day, the case proving fatal in thirty-six hours; the other, a feeble woman, sixty-four years of age, who died between the second and third week.[2] In 14 excisions of the elbow, Mr. Erichsen had but one death;[3] and of 11 patients operated on by Roux, all of which were complete excisions, 3 died.[4] This, it should also be remembered, was in Parisian hospitals, notorious for the bad results of capital operations.

The following table will, however, exhibit more exactly the results of excision of the elbow-joint.

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[1] On the Excision of Diseased Joints, (Edinb.,) p. 26.

[2] Liverpool Med. Chir. Journ., July, 1857, p. 201.

[3] Science and Art of Surgery, (3d ed., London,) p. 706.

[4] Brit. and For. Med. Chir. Rev., July, 1841, p. 253.

No.	Authority.	Sex.	Age.	Partial or Complete.	Time under Treatment.
1	Lancet, Jan. 18, 1853.	F.	44	Complete.	8 mos.
2	Ibid., Dec. 4, 1852.	M.	24	Partial.	8 mos.
3	Ibid., Dec. 11, 1852.	M.	35	Complete.	16 days.
4	Med. Times and Gaz., June 23, 1855.	F.	38	Partial.	3 weeks.
5	Ibid., Jan. 3, 1857.	M.	8	"	
6	Ibid., Feb. 20, 1858.	M.	10	Complete.	6 mos.
7	Dublin Hosp. Rep., Vol. IV. p. 191.	M.	23	Partial.	7 mos.
8	Lancet, Oct. 4, 1856.	M.	4½	"	3 mos.
9	Ibid., Oct. 11, 1856.	F.	20	"	11 mos.
10	Ibid.	F.	31	Complete.	3 mos.
11	Ibid.	F.	57	"	2 mos.
12	Ibid.	M.	17	"	2 mos.
13	Ibid., Mar. 3, 1855.	M.	38	"	
14	Med. Times and Gaz., Mar. 31, 1855.	M.	21		1 month.
15	Ibid., May 12, 1855.	M.	20	Complete.	3 mos.
16	Lancet, Jan. 28, 1854.	M.	45	"	1 year.
17	Thore (Thêse), p. 81.	F.	26	"	18 mos.
18	Med. Times and Gaz., Apr. 21, 1860.	M.	45	"	1 year.
19	Ibid.	M.	25	"	9 mos.
20	Ibid.	M.	16	"	2 mos.
21	Ibid.	M.	13	Partial.	9 mos.
22	Ibid., May 5th, 1860.	M.	29	Complete.	6 weeks.
23	Lancet, Nov. 28, 1857.	F.	21	"	6 mos.
24	Ibid.	F.	14	"	3 mos.
25	Ibid.	M.	26	"	2 mos.
26	Philad. Med. Ex., Sept. 24, 1852.	M.	32	"	3 mos.
27	Thore (Thêse), p. 24.	M.	50	"	4½ mos.
28	Ibid., p. 26.	M.	26	"	4½ mos.
29	Ibid., p. 52.	M.	27	"	16 days.
30	Ibid , p. 58.	M.	10	Partial.	7 days.
31	Ibid., p. 71.	F.	41	Complete.	5 mos.
32	Ibid., p. 74.	M.	22	"	11 mos.
33	Lancet, Oct. 1, 1857.	F.	3½m.	"	3½ mos.
34	Chicago Med. Journ., Sept. 1858.	M.	26	"	14 mos.
35	Am. Journ. of Med. Sc., Vol. XIX. 1836.	F.	26	"	6 mos.
36	Ibid., Oct. 1856.	F.	28	"	6 mos.
37	New York Med. Journ., Mar. 1860.	F.	30	"	
38	Lancet, Nov. 28, 1857.	M.	13	"	
39	Med. Times and Gaz., May 8, 1858.	M.	16	"	6 weeks.
40	Ibid.	F.	16	"	1 month.
41	Ibid.	F.	20	"	1 month.
42	Guy's Hosp. Reports, 1836, p. 268.	M.	30	"	11 mos.
43	Ibid., 1840, p. 81.	M.	26	"	
44	Ibid.	M.	43	Partial.	6 weeks.
45	Ibid., 1841, p. 369.	M.	17		2 mos.
46	Mass. Gen. Hosp. Records.	M.	52	Partial.	4 weeks.
47	Ibid.	M.	35	"	5 mos.
48	Ibid.	M.	24	Complete.	5 mos.
49	Ibid.	M.	29	"	6 mos.
50	Med. Times and Gaz., May 3, 1856.	F.	15	"	6 mos.
51	Ibid.	F.	20	"	6 mos.
52	Ibid.	F.	20	"	4 mos.
53	Ibid., Aug. 9, 1856.		5	Partial.	2 mos.
54	Ibid., June 12, 1858.	M.	24	Complete.	9 mos.
55	Ibid., Dec. 13, 1856.	F.	11	"	2 mos.
56	Ibid.	M.	63	"	2 mos.
57	Lancet, Mar. 22, 1856.	M.	11	Partial.	8 mos.
58	Ibid., Oct. 4, 1856.	F.	23	Complete.	6 weeks.
59	Ibid.	F.	10	"	3 mos.
60	Ibid., Oct. 11, 1856.	F.	25	"	4 mos.

Termination.	Remarks.
Useful arm.	Operator condemned for not amputating.
Not healed.	Not in an encouraging state.
Died.	Erysipelas. Left arm.
"	Pneumonic phthisis.
Anchylosis.	Excision of outer condyle.
Useful arm.	Amputation thought by many the proper operation.
" "	Slight degree of motion. Able to write. Right arm.
Amputated.	Disease returned. Left arm. Recovered.
"	Head of radius, which was left, found carious. R. arm. Recov.
Anchylosis.	Right arm.
"	Elbow not of much use.
"	Wrist and fingers useful. Right arm.
Useful arm.	Knows no difference in his two arms.
Died.	Pyæmia.
Useful arm.	Good motion.
" "	Returned to his employment.
" "	Movements remarkably free.
" "	Right arm.
Died.	Phthisis. Parts not in a hopeful condition. Left arm.
Useful arm.	Fair amount of motion. Right arm.
Anchylosis.	Good use of hand and fore-arm.
Amputated.	Profuse suppuration. Recovered.
Useful arm.	Almost perfect flexion, extension, and rotation. Right arm.
" "	Plenty of motion. Left arm.
" "	Can raise his hand to his mouth. Right arm.
" "	Free flexion and extension. Right arm.
" "	Uses his arm as well as any one. Right arm.
" "	Tolerably free motion. Left arm.
Died.	Erysipelas. Right arm.
"	Convulsions. Left arm.
Useful arm.	Movements tolerably free. Left arm.
" "	Flexion and extension free. Right arm.
" "	Flexion enough to let thumb reach mouth. Left arm.
" "	Dresses and feeds himself. Flexion 50°. Earns fine wages.
" "	Nearly all the motions of the joint.
" "	Extension, flexion, supination, pronation.
" "	Perfect use of arm. Right arm.
" "	Good use of arm. Left arm.
" "	Flexion and extension free.
Amputated.	Recovered. Extension of disease.
Useful arm.	Recovery rapid and complete.
" "	Remarkable freedom of motion. Right arm.
" "	Resumed occupation of postman. Right arm.
" "	Can raise a heavy stool above his head. Left arm.
" "	Able to carry hand to mouth. Left arm.
Died.	Exhaustion.
"	Phthisis. Right arm.
Useful arm.	Motions limited. Right arm.
Amputated.	Disease of bones returned. Recovered. Right arm.
Useful arm.	Good recovery.
" "	Movements of joint almost perfect.
" "	Can write and sew.
Amputated.	Disease of soft parts. Recovered.
Useful arm.	Lifts a heavy chain; carries a bucket. Left arm.
" "	Fair motion.
" "	Fair motion.
" "	Limited flexion. Right arm.
" "	Promises improvement.
Died.	Phthisis.
Unpromising.	Right arm.

No.	Authority.	Sex.	Age.	Partial or Complete.	Time under Treatment.
61	Med. Times and Gaz., Oct. 13, 1855.	M.	14	Complete.	3 mos.
62	Lancet, Jan. 28, 1854.	M.	37		9 mos.
63	Ibid.	M.	60	Complete.	2 weeks.
64	Ibid., Dec. 11, 1852.	F.	5	Partial.	2 weeks.
65	Ibid.	M.	12	"	7 weeks.
66	Ibid.	F.	8	Complete.	4 mos.
67	Ibid., Jan. 15, 1859.	M.	40	"	
68	Ibid., May 31, 1851.	M.	31	"	4 mos.
69	Med. Times and Gaz., Nov. 4, 1854.	F.	50		2 years.
70	Ibid., June 5, 1858.	F.	14		3 mos.
71	Ibid.	F.	15		3 mos.
72	Lancet, April 27, 1850.	M.	17	Complete.	8 mos.
73	Dublin Quarterly, Feb. 1859.	F.	25	"	9 mos.
74	Ibid.	M.	24	Partial.	9 mos.
75	Edinb. M. and S. Journ., Aug. 1859.	M.	13	Complete.	13 mos.
76	London Med. Gaz., Vol. X. p. 430.	M.	18	"	1 month.
77	Ibid., Vol. VII. p. 555.	F.	24	"	5 mos.
78	Med. Times and Gaz., Apr. 30, 1859.	F.	10	"	4 mos.
79	Ibid., Apr. 21 and May 5, 1860.	M.	32	"	
80	Dublin Quarterly, Nov. 1855.	M.	56	"	6 weeks.
81	Lancet, Mar. 19, 1859.	M.	16	"	9 mos.
82	Med. Times and Gaz., Apr. 30, 1859.	M.	18		10 weeks.
83	Am. Journ. of Med. Sc., Oct. 1846.	M.	25	Complete.	6 mos.
84	Lancet, Aug. 26, 1848.	M.	16	"	3 mos.
85	Association Journal, Aug. 4, 1854.	M.	21		Several mos.
86	Ibid.	F.	21		Many mos.
87	Ibid., June 23, 1854.	M.	49		3 mos.
88	Ibid.	M.	22		1 year.
89	Med. Times and Gaz., Apr. 30, 1859.	F.	21		
90	Ibid., Aug. 19, 1854.	M.			1 month.
91	Ibid., May 1, 1852.	M.	30	Complete.	6 mos.
92	Ibid., Jan. 3, 1852.	M.	16	"	7 mos.
93	Ibid.	M.	12	"	1 year.
94	Lancet, Jan. 15, 1859.	M.	38	"	
95	A. Tobold, De Artic. Cub. Resect., p. 17.	M.	16	"	7 mos.
96	Jeffray's Park and Moreau, p. 96.	M.	19	"	
97	Ibid., p. 110.	M.		"	7 mos.
98	Ibid., p. 114.	M.		Partial.	3 mos.
99	Schillbach, Resect. der Knoch., p. 177.	M.	25	Complete.	7 mos.
100	Ibid., p. 183.	M.	30	"	9 mos.
101	Ibid., p. 187.	M.	26	"	3 mos.
102	Ibid., p. 195.	M.	59	"	1 month.
103	Ibid., p. 202.	M.	27	Partial.	5 mos.
104	Heyfelder, Resect. und Amp., p. 136.	M.	23	"	16 weeks.
105	Ibid., p. 139.	M.	34	"	10 weeks.
106	Ibid., p. 140.	F.	61	Complete.	6 days.
107	Ibid., p. 142.	M.	43	"	2 mos.
108	Ibid., p. 145.	F.	33	"	9 mos.
109	Med. Times and Gaz., Aug. 4, 1860.	F.	21	"	1 month.
110	Tr. Path. Soc. Lond., Vol. IX. p. 223.	F.	47	"	5 days.
111	Med. Times and Gaz., Sept. 8, 1860.	M.	68	"	4 mos.
112	Am. Med. Times, Sept. 22, 1860.	M.	23	"	10 mos.
113	Ibid.	M.	18		$2\frac{1}{2}$ mos.
114	Ibid.	M.	10	Complete.	2 mos.
115	Ibid.	M.	14		7 weeks.
116	Ibid.	M.	40		2 weeks.
117	Statham's Resections, p. 117.	F.	74	Complete.	8 mos.
118	Lancet, Nov. 3, 1860.	M.	30	Partial.	10 mos.
119	Arch. Gén. de Méd., [4.] T. 24, p. 357.	F.		Complete.	

Termination.	Remarks.
Useful arm.	Promises improvement.
“ “	Works at shoemaking. Left arm.
Amputated.	Died of phthisis six weeks after amputation.
Died.	Pyæmia. Right arm.
Useful arm.	Serves all ordinary purposes. Right arm.
“ “	Movements free.
“ “	Equal to its fellow. Right arm.
“ “	Movements free and strong. Right arm.
“ “	Does duty of a cook in a large house.
“ “	Fair motion; improving daily.
Died.	Hectic and exhaustion.
Useful arm.	Flexion free; lifts a fifty-six pound weight. Left arm.
Anchylosis.	Five inches removed. Uses hand perfectly. Right arm.
Useful arm.	Is now a day-laborer. Right arm.
“ “	Nearly as efficient as the other.
“ “	Motions sufficiently free. Right arm.
Amputated.	Neuralgia. Recovered. Left arm.
Useful arm.	Fair motion.
Amputated.	Recovered. Right arm.
Useful arm.	Good motion. Right arm.
“ “	Almost as good as the other. Right arm.
Amputated.	Disease of soft parts. Recovered.
Useful arm.	Motions free and strong. Right arm.
“ “	Motions limited. Right arm.
Amputated.	At patient's request. Returning disease.
“	Limb being an encumbrance.
“	For pain. Died ten months after.
Useful arm.	Good flexion.
“ “	Fair motion.
Died.	Pneumonia.
Useful arm.	Works like other people. Left arm.
Anchylosis.	Useful hand. Nearly whole ulna removed. Right arm.
“	Useful hand. Right arm.
Useful arm.	Equal for all purposes to its fellow. Right arm.
“ “	Motion free and strong. Left arm.
“ “	Motions extensive. Left arm.
“ “	Flexion good. Right arm.
“ “	Works as a shoemaker. Right arm.
“ “	As powerful and useful as the other. Left arm.
“ “	Resumed trade of carpenter. Right arm.
“ “	Complete use of elbow. Right arm.
Died.	Pyæmia. Left arm.
Useful arm.	Motions very limited. Right arm.
“ “	Does duties of a servant. Right arm.
“ “	Motions only tolerable. Left arm.
Died.	Death from exhaustion. Right arm.
Useful arm.	Works on a railroad. Right arm.
Amputated.	Useless limb at end of three years. Right arm.
Useful arm.	Does household duties with ease. Left arm.
Died.	Death from exhaustion. Right arm.
Useful arm.	Excellent motion. Left arm.
“ “	Excellent motion. Left arm.
“ “	Considerable motion. Left arm.
“ “	Good strength and motion. Right arm.
“ “	“Very free motion.”
Amputated.	On account of disease of soft parts. Recovery.
Useful arm.	Motion at elbow; stiff fingers. Left arm.
Anchylosis.	“Indifferent result.” Right arm.
Useful arm.	Flexion, extension, supination perfect.

The foregoing table is made up from a great variety of sources, as the references prove. It comprises all the cases which, with histories attached, have fallen within my range of research (excluding Mr. Symes's series), and the disease in every instance was "white swelling" in some one of its various phases and stages.

Of the 119 cases of which it consists, 80 were males and 38 females, the sex in one case not being mentioned. In only 73 is the side operated upon reported, and of these 48 were of the right and 25 of the left. The age of the oldest patient, of those where it is stated, was 74 years, and of the youngest, 14 weeks; both of these recovered, the former with a flexible elbow but stiff fingers, the latter with a useful arm.

A fatal termination occurred in 15 cases, from the following causes, and at the subjoined periods of time after the operation: —

3 of phthisis, at the end of 9, 5, and 3 months respectively.

1 of phthisis and pneumonia, at the end of 6 weeks.

1 of pneumonia, at the end of one month.

4 of exhaustion, at the end of 3 months, 4 weeks, 6 and 5 days.

3 of pyæmia, at the end of one month in two, and 2 weeks in the third.

2 of erysipelas, at the end of 16 weeks in each case.

1 of convulsions, at the end of 7 days.

In 15 cases, subsequent amputation was rendered necessary for the following reasons, and after the periods of time named in connection with each: —

In 2 the limb being an encumbrance; one at the end of 3 years, the other after "many months."

In 3 for disease of the soft parts, at the end of 10, 8, and 2 weeks.

In 5 for returning disease of the bones, at the end of 11, 6, 5, 3, and 1 months.

In 2 for pain, at the end of 5 and 3 months.

In 1 for profuse suppuration, at the end of 6 weeks.

In 2 for reasons not given, at the end of 2 weeks, and of a period not stated.

From these amputations, 10 patients recovered and 2 died; one at the end of 10 months, for a cause not mentioned, the other of phthisis at the end of 6 weeks. In 3 the result of the secondary operation is not stated.

Of the 89 cases recovering without amputation, 77 regained useful arms. In 8 the operation was followed by anchylosis, the hand and fore-arm remaining useful. One case at the end of 8 months was unhealed and in a discouraging state; one at the expiration of 4 months was "unpromising," and one, with a movable elbow, had yet a stiff wrist; while in still another the result was an "indifferent one."

The degree of usefulness retained varies from a condition where only the hand was serviceable, up to a perfection nearly equal to that of the natural state. Too great mobility sometimes impairs the serviceableness of an arm as much as too great rigidity. Such a result appears to have occurred not unfrequently in the experience of M. Roux. (Thore.) Flexion is generally better performed than extension, whilst pronation and supination often remain quite perfect. A frequent test of strength appears to have been the carrying of a pail of water, and this seems often enough to be readily done. One of Moreau's patients ultimately threshed corn and held the plough. A patient of Mr. Key's became a letter-sorter in the post-office. A railway guard, operated on by Mr. Syme, says he knows no difference in his two arms. A patient of Mr. Cock's, nine months after the operation, boasted that he could make more shoes in a given time than any man in London. In fact, in all successful cases, the ordinary occupations of life are resumed, and patients soon learn to accommodate themselves to the limitation of movements which follows the operation.

The perfect co-ordination of muscular action which characterizes the normal state of things is almost always somewhat deranged. Flexion, for example, is accomplished in two steps; first the triceps contracts, the fore-arm is lifted, and a fulcrum obtained; the biceps then acts and produces flexion. These motions, M. Robert, who has called attention to them,[1] says still exist in one of his patients, fifteen years after the operation, and are already apparent in another which is only convalescing; they were also sufficiently distinct in a patient operated on by Dr. J. O. Stone, of New York.[2]

It has been alleged that, as a rule, young persons do best after excision of the elbow; there being in the adult a greater tendency towards anchylosis to overcome.[3] This statement is not supported by the cases under consideration. The ages of the patients whose elbows became anchylosed were 57, 31, 25, 17, 16, 13, 12, and 8. Taking eight of the oldest patients in the table, and whose ages were respectively 74, 68, 63, 61, 60, 57, 56, 52, the results will be found to have been, useful arms in three, aged 68, 63, 56; anchylosis in one, aged 57; a flexible elbow but stiff fingers in one, aged 74; death from exhaustion at the end of four weeks in one, aged 52, and in six days in another, aged 61; amputation at the end of two weeks, and death from phthisis six weeks afterwards, in one, aged 60. From this it would appear that anchylosis is not especially to be dreaded on account of advanced years, but that the mortality increases with the age of the patient, as in most operations.

The following table presents a summary of what has just been stated.

It appears therefrom, that the percentage of mortality is 12.60, and of failures, i. e. deaths and amputations, 25.20. Of this latter class, 9 excisions were of the right elbow, 6 of the left, and in 15 the side is not stated.

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[1] Gaz. des Hôp., Nov. 20, 1858.

[2] N. Y. Journ. of Med., May, 1851, p. 302.

[3] Lancet, Oct. 4, 1856.

No. of Cases.	Sex.	Side.	Result.	
119	80 Males.	48 Right.	89 Recovered	77 Useful arms. 8 Anchylosis. 4 Unsatisfactory.
	38 Females.	25 Left.	15 Amputated	10 Recovered. 2 Died. 3 Not stated.
	1 Not stated.	46 Not stated.	15 Died.	

This is not materially different from the results of other collected cases. Thus, the table of M. Thore, who does not give the number of deaths, comprises 88 cases with 20 failures (*insuccès*), or 22.72 per cent.[1] Blasius gives 90 cases with 10 deaths, 8 in which the result is not stated, and 2 in which the caries returned.[2] Subtracting the 8 cases without result, we have remaining 82 excisions and 10 deaths, or a mortality of 12.20 per cent. The mortality by O. Heyfelder's table is 11.18.[3]

According to Malgaigne, of 61 amputations of the upper arm for disease, 24, or 39.09 per cent, died.[4] Dr. Gross, from the addition of several tables (94 cases and 20 deaths), makes the mortality 21.24 per cent.[5] The sources from which the first of these statements is derived, and the manner in which the second is made up, comprising, probably, amputations for both traumatic and organic lesions, render them of little value for purposes of comparison with the table of excisions. They perhaps authorize the conclusion, that excision is less fatal than amputation, though they are inadequate to decide in what proportion it is so.

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[1] De la Résection du Coude, p. 42.

[2] Beitrage zur Praktischen Chirurgie, cited in B. and F. Med.-Chir. Rev., April, 1851, p. 285.

[3] Operationslehre, u. s. w., p. 247.

[4] Arch. Gén. de Méd., Avril, 1842.

[5] System of Surgery, (Philad. 1859,) Vol. I. p. 653.

OPERATION AND AFTER-TREATMENT.

THE elbow may be excised by a variety of methods, the principal difference between which is in the incisions deemed proper. Perhaps the best is that of Langenbeck, of Berlin, consisting of a single straight incision carried along the inner border of the olecranon, and extending two inches above and below its extremity.[1] It possesses the merit of simplicity, and of allowing the ready approximation of the edges of the incision without gaping of the wound. It is only objectionable on account of the liability of the skin to tear, whenever the soft parts are diseased or stiffened by infiltration, during the extreme flexion necessarily made in exposing the ends of the bones. It is, therefore, most applicable to excisions for traumatic cause. The addition of an external lateral incision, falling upon the centre of the longitudinal one, obviates the difficulty just named, and converts the operation into that described in the books as Jaeger's,[2] or Liston's.[3]

In the five operations performed by the Moreaus, loss of sensation in the little finger, numbness of the ring finger, and wasting of the ulnar side of the hand, are described as having been constant accompaniments. These accidents, due to the division of the ulnar nerve, are said to have been first obviated by Dupuytren,[4] but Wachter, in 1810, had insisted upon the importance of its preservation intact.[5] The exposure of the joint should be so conducted that the sheath of the nerve, where it lies in the groove beside the olecranon, shall not be interfered with. The disorganization of the soft parts is sometimes so great, that the position of the nerve can with difficulty be decided upon, and its place only determined after the bones have been partly laid bare; the operation may, however, often be performed so that it is neither exposed nor seen. Although there is a possibility that sensation may be regained, even if the nerve has been divided, this ought never to be done, unless by accident, when prevention is so easy and a cure so doubtful. In compound fracture of the internal condyle, the nerve is liable to be severed by the accident itself.

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[1] A. Tobold, De Articuli Cubiti Resectione, (Berlin, 1855,) p. 13.

[2] Bourgery, Méd. Opér., p. 216.

[3] Practical Surgery, (3d ed., London,) p. 156.

[4] Malgaigne, Méd. Opér., (5^{me} ed., Paris,) p. 222.

[5] De Artic. Extirp., p. 77.

When the bones are fairly exposed, — and this, owing to the shape of the articulation, is a dissection requiring time, and one of no little difficulty, especially about the inner condyle, — division of the lateral ligaments and conjoined tendons freely opens the interior of the joint.

In a large proportion of cases only the surface of the articulation is diseased, and that alone need be removed. The extent of the excision, however, should be such, that, when the parts are brought together, the bones shall neither lock, nor the transverse incision gape, in bending the arm to a right angle. The insertions of the biceps and brachialis anticus muscles are to be preserved if possible, and it is to be remembered that, in dividing the ulna and radius low down, the interosseous artery is endangered.

Four inches of bone above and four inches below the joint have several times been removed, and a useful arm left. Birne, cited by Velpeau,[1] describes a gun-shot wound of the elbow which carried away fourteen and a quarter inches of the bones, and yet the patient recovered with an interval of only fifteen lines between them, and could lift a weight of forty pounds. He raised his arm by a sudden jerk and a vigorous contraction of the muscles of the shoulder, and when the arm had been thus carried up, the fingers acted voluntarily. Without deciding whether such an amount of removal, intentionally done, is admissible, I content myself with expressing the opinion, that no precise limit can be fixed, but that the extent to which the bones may be excised is a question for the judgment of the surgeon to determine in each case, upon its own merits and the circumstances which accompany it. Mr. Erichsen thinks that one of the chief dangers in the operation is the myelitis liable to occur from opening the medullary canal of the humerus in dividing the bone high up. He has seen it take place in three instances.[1] Mr. Stanley speaks of a case where, apparently, this accident occurred with a fatal result.[2] The observation deserves attention, although in no instance does the occurrence appear to have taken place in the cases comprised in my table.

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[1] Blackman's Edition, Vol. II. p. 457.

In the excision of no joint for disease have partial operations been so universally condemned as in that of the elbow. Without an exception, all surgeons who have often operated decide against them. Among these may be mentioned Mr. Syme, Mr. Bickersteth, Mr. Erichsen, and Mr. Fergusson. The latter says: "Although not prepared to give a positive opinion on the subject, as far as my own experience goes, I am disposed to think that it is not doing justice to the patient to take away only one half of a joint in resection (of the elbow), and that it is better that the opposing articular surface should be removed at the same time."[3] M. Thore, in 1843, with his comparatively limited experience, says: "Anchylosis never, or almost never, follows excision of the elbow. When I say this, I mean complete excision, for the chances of anchylosis are infinitely greater when one of the articulating surfaces is left."[4]

According to Blasius, already quoted (p. 65), in 24 successful cases out of 28 partial excisions, 6 were cured with, and 10 without anchylosis; the remainder were uncertain.

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[1] Lancet, Oct. 4, 1856.

[2] On Diseases of Bones, (Am. ed.,) p. 38.

[3] Med. Times and Gaz., June 12, 1858.

[4] De la Résect. du Coude, p. 64.

In 48 cases of complete excision, anchylosis occurred but 7 times. According to O. Heyfelder, in 79 partial excisions for injury and disease, (no distinction being made between the two in his summary,) 8 died, 3 were amputated, 14 became anchylosed, and 54 recovered with useful limbs; this represents one failure in every 3⅕ cases. On the other hand, in 207 complete excisions, 24 died, 7 were amputated, 5 became anchylosed, and 171 regained useful limbs; one failure in only 5¾ cases.[1]

In 21 cases of partial excision contained in the table on pages 58 *et seq.*, 9 resulted in useful arms, 5 died, 3 were subsequently amputated, 3 ended in anchylosis, and one at the end of 8 months remained unhealed and in an unpromising condition. Although these figures do not indicate that anchylosis is the most common accident of partial excision, they abundantly prove, so far as they go, the frequent occurrence of unfavorable results, since in these 21 cases is comprised one third of all the deaths incident to the whole number (119) of excisions.

With regard to the length of treatment necessitated by the operation, it will be found that months, or years, or even a whole life-time, may elapse before the occasional occurrence of small collections of matter in and about the joint will cease; but these rarely interfere with the patient's comfort, or affect the usefulness and strength of the limb. This is well illustrated by the case of a man, forty-five years old, entering Guy's Hospital under the care of Mr. Cock. His elbow had been excised eighteen years before, by the late Mr. Aston Key; he had had good health and excellent use of his arm all the time. His occupation being that of a letter-sorter, he had recently tried to work with his arm in a new and unaccustomed position; an abscess formed, and Mr. Cock, on opening it, found it to be caused by a limited necrosis of the end of the humerus; this he removed, together with some loose fragments, and the man shortly after resumed his business.[1] In cases of recurrence of the disease, Erichsen advocates the resort to a second operation. Indeed, he mentions an instance in which he "excised the bones about the elbow for a *third* time with perfect success." The patient, a boy about fourteen years of age, obtained a most useful arm, "regaining the four movements of the joint, — pronation, supination, flexion, and extension."[2]

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[1] Operationslehre und Statistik der Resectionen, p. 247.

M. Thore observes, that even at an early period patients may commence the use of their arms, but only after the lapse of years does the limb attain the full measure of ease and perfection in its movements. "In general terms it may be said, that towards the end of the first or second year motion is sufficiently free, and the limb strong enough to be really useful."[3]

The "time under treatment" is recorded in 77 of the cases of recovery included in my table. This has reference, not to the time when full usefulness of the limb was restored, but to the period during which the patient required surgical care, and at the end of which he was able to commence the use of his arm. This varies from 4 weeks to 2 years, and averages $175\frac{3}{11}$ days, or $5\frac{5}{6}$ months. According to Sansom, 110 days is the average duration of treatment after amputation of the arm.[4]

DISSECTIONS.

In 1855, Mr. Syme, with all his experience, had seen but two dissections of elbow-joints after the lapse of any length of time from the excision. In one, the operation had been performed ten months; in the other, which was followed by a most successful result, nine years had elapsed. In the first, "the place of the extremities of the bones was occupied by a mass of strong fibrous tissue, closely resembling ligament, which allowed of motions in all directions. The triceps was attached to the posterior surface of this newly-formed ligament, and, through means of it, to the extremity of the ulna."[1] In the second case, the ends of the bones were adapted to each other in such a way as to form a hinge-joint. There had been an extensive growth of bone and ligament, and the osseous surfaces of the new articulation were covered with a fibro-cartilage, or smoothed over by a porcellaneous deposit, and lubricated by a sort of synovia: the ulna and radius were received between two osseous processes growing downwards from the end of the humerus.[2] The drawing which accompanies this last description presents a striking resemblance, with respect to these processes, to a specimen falling under my own observation, taken from a man whose arm was amputated five months after excision of the elbow, and in which two cornua, projecting from the end of the humerus, were a marked and peculiar feature. In a case dissected by Mr. A. M. Edwards, of Edinburgh, six months after the excision, there was fibrous union of the divided ends, and the specimen also exhibited some "nodules of bone at the lower end of the humerus, which the reporter suggested were rudimentary condyles of new growth."[3]

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[1] Med. Times and Gaz., Oct. 24, 1857.

[2] Sc. and Art of Surg., (3d ed., London,) p. 706.

[3] De la Résect. du Coude, p. 67.

[4] Mortality after Operations of Amputations, (London, 1859,) p. 19.

In a partial excision of the elbow, where the end of the ulna only was removed, the motions of the arm returning, at the end of nine months, "a bony process, resembling the olecranon, could be felt given off from the end of the ulna and connected with the triceps muscle, as could be easily made out in extending the arm."[4]

From the dissections collated by Albrecht Wagner, it appears that complete pseudarthrosis was found in but one case; in this the trochlea of the humerus appeared as perfect as if none of it had been taken away; in all the others, the bones were either rounded, and united by a fibrous medium, or more or less completely anchylosed from muscular adhesions, the shortness or density of the uniting fibrous tissue, the too close approximation of the bones from muscular contractions, or the formation of a superabundant callus. In no case had a new articular capsule been formed. The muscles had fixed themselves to the processes and irregularities of the bones which had been gradually developed, and were generally atrophied, or more or less fatty. The nerves were softened, enlarged, and also fatty, and to this degeneration he thinks the loss of power in the limbs may be attributable.[1]

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[1] On Excision of Diseased Joints, p. 91.

[2] Lancet, Mar. 3, 1855.

[3] Edinb. Month. Journ. of Med. Sc., Dec. 1860.

[4] T. Holmes, in New Sydenham Society's Publications, Vol. V. p. 233.

In the first case dissected by Mr. Syme, the nerve, which had been completely divided at the time of the operation, was found perfectly reunited.[2] A similar case occurred to M. Roux. The ulnar nerve was not only divided, but a portion of it excised. The little finger and the ulnar side of the ring-finger were wholly deprived of feeling. A year later, sensation had entirely returned, and when, fourteen years after the operation, the patient was again examined, the sensation of one arm was equally perfect with that of the other.[3] Such results are probably of rare occurrence.

The regeneration of the removed bone by preserving the periosteum is a question still in abeyance, and requires the confirmation of dissections not yet made. M. Verneuil, well known as a careful observer, presented several cases of excision of the elbow to the French Academy in 1859, to show that, by dissecting off and preserving whatever of periosteum the disease has left, the shortening ordinarily ensuing might be obviated. Thus, in one case where four inches of bone were removed and this precaution taken, the shortening was but two inches. In another instance, a cylinder of periosteum was preserved with satisfactory results.[1]

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[1] On the Process of Repair after Resection and Extirpation of Bones, New Syd. Soc., Vol. V. p. 121.

[2] On Excision of Diseased Joints, p. 92.

[3] De la Résect. du Coude, p. 78.

CONCLUSIONS.

It may be concluded from what has been said in the preceding pages, —

First. That although partial excision had been practised upon several occasions, and by Mr. Wainman, in England, so early as 1758 – 59, the first complete excision of the elbow-joint was performed by the elder Moreau, in 1794.

Second. That excision for traumatic cause appears to be a safer operation than amputation, and ordinarily preserves a limb of very considerable usefulness. This is especially true of those occurring in civil practice.

Third. That excision for anchylosis is only adapted to cases where the arm has stiffened in a straight position, or in one of extreme flexion, unless special circumstances authorize the risk of an operation frequently ending in no improvement of the anchylosis.

Fourth. That in excision for disease, death occurs once in $7\frac{14}{15}$ cases; and that the operation fails of its primary intention, — the riddance of the disease with the preservation of a useful arm, — by death, amputation, or other cause, once in $3\frac{17}{34}$ cases. Patients recovering are usually able to resume their ordinary occupations.

Fifth. That partial excision, either for traumatic or organic lesions, is a frequent cause of unfavorable results.

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[1] Arch. Gén. de Méd., Janv. 1860, p. 107.

WRIST-JOINT.

HISTORY.

THE earliest approach to this excision is to be found in the "Cases and Practical Remarks in Surgery" of Benjamin Gooch, published in 1758, where Mr. Cooper, of Bungay in England, is reported to have "succeeded to his wish in sawing off the head of the radius, which passed through and made a dismal laceration of the tendons at the wrist, and the patient found little or no defect in the strength or motion of the joint." Mr. Gooch adds, "I have also succeeded beyond my expectation in cases of this nature, by the same practice." (p. 104.) M. Bagieu, at about the same period as in the preceding instance, removed the comminuted bones of the wrist-joint, crushed and disintegrated by a gun-shot injury; anchylosis followed, and the fingers were left so flexible, that the patient, a soldier, aged twenty-five, was able to write and draw, and retained to a very considerable extent the shape of the hand.[1]

In 1773, Mr. Orred, of Chester, sawed off, for a disease which was probably necrosis, more than three inches of the ulna;[2] and about the same period, Bilguer, as it appears from Wachter, did the same in a case of injury.[3] But these can hardly be classed amongst excisions of the wrist-joint.

In July, 1794, the elder Moreau excised the wrist, for acute necrosis, in a man aged seventy-one, who had already lost his other hand from a similar cause; on the 29th of the same month the case terminated fatally, from the intensity of the primitive inflammation. Subsequently, the younger Moreau operated for caries upon a female, who, in the end, recovered sufficiently to resume her occupation of a seamstress. M. Roux was also an early operator, two instances being on record of its performance by him; one case, in which the end of the radius only was excised, required subsequent amputation, of which the patient died; the other resulted more satisfactorily.[1]

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[1] Examen de plusieurs Parties de la Chirurgie, Tom. II. p. 446.

[2] Philos. Trans. Lond., Vol. LXIX. p. 6.

[3] De Artic. Extirp., p. 19.

In 1800, M. St. Hilaire, of Montpellier, removed the ends of both radius and ulna for a compound dislocation with perfect success. The same was afterwards done by M. Hublier, of Provins, in 1828, for a compound dislocation, with rupture of the tendons, and by MM. Huguier and Rossi for gun-shot wounds.[1]

In 1839, Dietz removed the ends of the radius and ulna, and all the carpal bones, for caries in a man aged forty. A return of the disease rendered amputation of the arm necessary four years afterwards.[2]

These cases, scattered in periodicals and articles in Encyclopædias, seem to have attracted but little attention, and the operation appears not to have been performed again until reintroduced by Mr. Fergusson in London, August 16, 1851.[3]

Dr. Lewis A. Sayre, of New York, performed a partial excision of the wrist in December, 1853. He desired to remove both rows of carpal bones, but was dissuaded by his colleagues in the hospital. To this he attributes his failure, subsequent amputation having been found necessary.[4] According to Dr. Blackman, the wrist has also been excised by Dr. Carnochan; and Prof. Pancoast has removed the upper row of carpal bones.[5]

The wrist-joint has been excised both for traumatic cause and for disease.

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[1] Dict. des Sc. Méd., Art. *Resection;* Dict. en 30 Vol., Art. *Poignet;* Blackman's Velpeau, Vol. II. p. 448; Bulletin des Sc. Méd., Vol. XVII. p. 398; L. Champion, Traité de la Résection des Os Cariés (Paris, 1815).

[2] Ried, ueber Resectionen, p. 364, cited by O. Heyfelder, p. 262.

[3] Lancet, Jan. 28, 1854.

[4] N. Y. Journ. of Med., May, 1854, p. 443.

[5] Blackman's Velpeau, Vol. II. p. 449.

EXCISION FOR INJURY.

No special rule as to the adaptability of this particular excision to military surgery can be deduced from its performance after a gun-shot injury by M. Bagieu,[1] from the cases of MM. Huguier and Rossi, or from the three instances operated on in the Crimea, with one fatal result.[2]

Equally impossible is it to draw any conclusive deduction from the cases of compound dislocation of Cooper of Bungay, St. Hilaire, Hublier, Adelmann, and Beck, or from the compound fractures of Ried and Just;[3] yet all of these were satisfactory in their results, with the exception of Beck's, which proved fatal. From all these facts together, it would seem, however, that excision of the lower end of the radius is an operation well suited for traumatic cases, especially when it is remembered that the hand, preserved in the most imperfect condition, is so great a gain over its entire loss.

Sir Astley Cooper, with only partial success, once extracted the scaphoid bone of the wrist for a compound dislocation, and he lays down the rule, that, when one or two of the carpal bones are dislocated, they may be removed; but if the injury is more extensive, amputation is necessary.[4] Malgaigne mentions the successful removal of a semi-lunar bone under similar circumstances, but with reference to excision says, that the "fabulous result announced by Gooch and Cooper is not to be hoped for."[5]

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[1] Dict. en 30 Vol., Art. *Poignet.*

[2] Med. and Surg. Hist. of the Brit. Army which served in Turkey and the Crimea, Vol. II. p. 377.

[3] Heyfelder, Operationslehre und Statistik der Resectionen, p. 270.

[4] Disloc. and Fract., (Am. ed.,) p. 436.

[5] Tr. des Luxations, (Paris, 1855,) pp. 711, 718.

EXCISION FOR DISEASE.

I AM aware of no case of excision of the end of the radius, or of any part of the wrist-joint, for malignant disease.

A specimen presented by M. Velpeau, of Paris, to the late Dr. John C. Warren, of Boston, who assisted in its removal by that distinguished surgeon, exhibits what appears to be a chronic inflammation of the extremity of the radius, without caries or implication of the articulation. No history accompanies it, nor is the result of the operation recorded.

The case operated on by Moreau for necrosis, and already alluded to as terminating fatally; another by Oskar Heyfelder, for a necrosis following a compound fracture which required amputation in twenty days, and resulted in death from pyæmia in nine more;[1] and one related by Champion,[2] where a countryman, long the subject of necrosis of the end of the radius, cut the bone off himself with a carpenter's chisel, and recovered with a hand unable to hold the lightest thing, do not offer encouraging precedents for other operations of the sort.

In cases of caries and white swelling, a larger, but still a limited experience, presents itself for consideration. The articulation of the wrist is not one of those most frequently diseased; — according to the records of Guy's Hospital, in only four per cent of all cases of diseased joints.[3]

Under the term "excision of the wrist, or radio-carpal joint," must be included not only the removal of what strictly constitutes that articulation (radius and first row of carpal bones), but all operations which excise a part or the whole of the ends of the radius and ulna, a part or the whole carpus, the proximal ends of the metacarpal bones, or all of these at once. Such an extensive removal is, however, rarely attempted, and the excisions practised in this locality are almost uniformly partial.

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[1] Operationslehre und Statistik der Resectionen, p. 269.

[2] Tr. des Os Cariés, p. 57.

[3] Bryant, Dis. and Inj. of Joints, p. 136.

The surgeon naturally hesitates before undertaking an operation so difficult of execution, and one in which he can hardly fulfil the first law of excisions; viz. that, together with the partial or complete removal of the articular extremities of the bones, there shall be a free exposure or destruction of the synovial cavity of the joint. "Any operation," says an able writer in the British and Foreign Medico-Chirurgical Review,[1] "which leaves the articulation in a condition approaching to that of a wounded joint, will lead to no good result, but will rather thenceforth be exposed to the dangers attendant on joint-wounds, and will terminate as such accidents are wont to do."

The inherent anatomical peculiarities of the radio-carpal and carpal articulations in the intercommunication of their synovial surfaces, of necessity render any excision which does not remove everything between the extremity of the radius and the ends of the metacarpal bones inclusive — the articulation of the thumb with the trapezium alone excepted — liable to the disadvantages just mentioned. For, in anything short of this, synovial surfaces must be left exposed, from which inflammation, suppuration, and ulceration of the cartilages will be liable to originate.

What prospects of success this excision holds out, the following quotations may serve to exhibit.

Mr. Fergusson, in 1857, says that he has, during the previous five years, excised the whole of the carpus four times. "But I am yet somewhat sceptical as to the results of such an operation. One patient preferred amputation to further delay; one died of consumption with the sinuses not yet closed; a third died of disease of the lungs and other ailments, with the wrist all but well; and the fourth, after protracted distress, ultimately died of phthisis. Within the above period, Mr. Stanley, of St. Bartholomew's, has removed a diseased carpus with, I believe, very satisfactory results. Of all the principal excisions associated with modern surgery, this is the one on which I have the least reliance; yet I think it worthy of further trial, for in whatever state the hand might be left, I believe it would prove more valuable than any artificial substitute."[1]

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[1] Oct. 1857, p. 229.

The writer in the British and Foreign Medico-Chirurgical Review, already cited, sums up 15 excisions for disease, — excluding operations on the carpus, not involving the wrist-joint, — as follows: 3 patients died, and 5 recovered with more or less useful hands; 3 were in progress of cure; whilst of 3 others the prospect for one was "hopeful," one "had some chance of recovery," and one was "unsatisfactory." The remaining patient, a man sixty-two years old, never had any use of his hand, though the wounds healed. The operators in these cases were Moreau, J. F. Heyfelder, Fergusson, Dr. Green of Bengal, Erichsen, Simon, Stanley, Butcher, Cock, and Page.[2]

The following table contains the above cases, together with such additional ones as have been published. Though their number is not large, the result in many not attained, and the extent to which the excisions were carried of very considerable variety, it still furnishes us, imperfect as the details are, with a tolerable opportunity to form definite opinions of the operation in question.

The table comprises memoranda of 39 cases; in 24 the patients were males, and in 12 females, the sex not being stated in 3; in 6 the excisions were of the right hand, and in 4 of the left, the side not being noted in the remainder. The age of the oldest patient is 62, and of the youngest 12 years. The former recovered with hardly any use of the hand; the latter, with tolerably good motion in the wrist and fingers.

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[1] Pract. Surg., (4th ed., Lond.,) p. 294.

[2] Oct. 1857, p. 231.

No.	Sex.	Age.	Length of Treatment.	Extent of Excision.
1	F.	28	6 mos.	Extremity of ulna and four carpal bones.
2	F.	58	7 days.	Ends of radius and ulna. All the carpal bones except trapezium. Right hand.
3	M.	62	6 mos.	Ends of radius and ulna. All the carpal bones.
4	M.	32	4 mos.	All the carpus except trapez. and pisiform. R. hand.
5	M.	13	Some w'ks.	All the carpus except trapezium.
6	M.	19	1 year.	All the carpus except trapez. and pisiform. L. hand.
7	F.	20	1 year.	End of radius, trapezium, scaphoid, and semilunar bones. Left hand.
8	F.	40	6 mos.	Not stated.
9	M.	44	2 mos.	Five carpal bones.
10	M.	36	6 mos.	Ends of radius and ulna. Trapezoid, scaphoid, cuneiform, magnum, semilunar.
11	M.	22	5 mos.	All the carpal bones except trapezium.
12	M.		5 mos.	All the carpal bones. Two operations performed.
13	M.	34	2 mos.	Ends of radius and ulna; entire carpus; ends of metacarpal bones. Right hand.
14	F.	28	45 days.	Ends of radius and ulna. First row of carpal bones. Right hand.
15	M.	30		Ends of radius and ulna. All the carpus except the trapezium.
16	M.	20	2½ y'rs.	Two thirds of 4th and 5th metacarpal bones; cuneiform, unciform, magnum, and trapezoid. R. hand.
17	F.	31	3 mos.	"Joint resected and several carpal bones removed."
18	M.	28	8 mos.	End of radius and most of the carpal bones.
19	M.	12	18 mos.	Ends of 1st, 2d, and 3d metacarpal bones; trapezium, trapezoides, and magnum. Left hand.
20	F.	30	1 year.	Remnants of os magnum and rough surfaces of surrounding bones. Left hand.
21	F.			End of radius.
22	M.	21		Trapezium, magnum, unciform, and pisiform.
23				One row of carpal bones.
24				End of radius.
25	F.	42	1 month.	Ends of radius and ulna.
26	M.	18		
27	M.		84 days.	Entire carpus.
28	M.	59	10 weeks.	End of ulna, cuneiform, and pisiform bones. L. hand.
29			6 mos.	Ends of radius and ulna.
30	F.	14		All the carpal bones.
31	M.	40		Ends of radius and ulna; all the carpal bones.
32	M.	35	3 weeks.	Ends of radius and ulna; all the carpal bones.
33	M.		1 year.	Ends of radius and ulna; all the carpal bones.
34	F.	20		Ends of radius and ulna; two carpal bones.
35	M.	25		Ends of radius and ulna.
36	F.	19		Ends of radius and ulna.
37	M.	29		End of radius.
38	M.	35		All the carpal bones.
39	M.	39	1 year.	All the carpal bones and bases of all the metacarpal bones.

Result.	Authority.
Did well, and some motion obtained.	Med. Times & Gaz., Mar. 21, 1857.
Died comatose. Sinuses and veins of brain and membranes engorged with blood.	Dublin Quarterly, Nov. 1855.
"Not much use of hand."	Med. Times & Gaz., May 3, 1856.
Much doubt whether hand will be saved.	Lancet, Aug. 25, 1855.
Excellent use of hand and fingers.	Ibid., Mar. 17, 1855.
Died of "continued fever." Parts unhealed.	Ibid., Jan. 28, 1854.
Stiff wrist, but useful fingers.	Med. Times & Gaz., May 20, 1854.
Stiff wrist and fingers.	Ibid., Nov. 4. 1854.
Amputated.	Ibid., Sept. 23 and Oct. 21, 1854.
Died of phthisis. No anchylosis was in progress.	Ibid., Nov. 1, 1856, and Lancet, Oct. 18, 1856.
Died of phthisis 19 months after operation.	Lancet, Jan. 28 and Mar. 11, 1854.
Amputated for disease of the soft parts.	Ibid., Apr. 3, 1858.
Useful hand. Considerable mobility of fingers.	Med. Times & Gaz., Apr. 14, 1860, Sc. & Art of Surg., 3d ed., p. 707.
Left the hospital with the wound still discharging.	Lancet. Jan. 21, 1854.
Healing slowly and sent into the country.	Med. Times & Gaz., Apr. 14, 1860.
Use of thumb perfect; writes with ease; motion of fingers considerable.	Dublin Quarterly, Nov. 1855 and Feb. 1859.
"Recov'd, but hand is not a promising one."	Med. Times & Gaz., Feb. 7, 1857.
Some prospect of motion.	Lancet, Jan. 28, 1854.
Flexion and extension of hand good. Phalanges of fingers have tolerable motion.	Schillbach, Resect. der Knochen, Part II., p. 216.
Anchylosis and limited motion of fingers.	Ibid., p. 224.
Able to sew.	Dict. des Sc. Méd., Art. *Résection.*
Doing well.	Charleston Med. J. & R., July, 1858.
Subsequently amputated.	N. Y. Journ. of Med., May, 1854.
Subsequently amputated.	Dict. en 30 Vols., Art. *Poignet.*
"Nearly well."	Journ. Hebd. de Med., Vol. 8, p. 214.
Some sinuses when made an out-patient.	Med. Times & Gaz., May 8, 1858.
Amputated.	Arch. Gén. de Méd., [5.] T. 2, p. 733.
At end of five years quite free use of hand.	J. F. Heyfelder, Res. u. Amp., p. 150.
Amputated for returning disease.	New Sydenh. Soc., Vol. V. p. 237.
"Almost unimpaired prehension."	Am. Med. Times, Sept. 22, 1860.
Amputation at end of four years.	O. Heyfelder, Opera'lehre, p. 262.
Wound healed; motion and sensation returned.	Ibid., p. 263.
Died from phthisis.	Ibid., p. 272.
No pronation or supination. Tendency to lateral displacement.	Ibid.
Amputated.	Ibid.
Recovered. Useful hand.	Ibid.
Died.	Ibid., p. 273.
Recovered. Useful hand.	Ibid., p. 274.
"Almost as useful as before the disease."	Bost. M. & S. Journ., June 27, 1861.

In these cases there were 17 recoveries. In 14 a more or less serviceable hand was regained, whilst in 3 it remained entirely useless; 6 patients died; 8 underwent subsequent amputation; and in 8 a definite result had not been reached.

Of the 6 fatal cases, 3 were from phthisis; one (No. 10), at the end of 6 months, no anchylosis being in progress; a second (No. 11), at the end of 19 months, the parts being still open and discharging badly 7 months after the operation; the third (No. 33), at the end of a year, but the condition of the wound is not stated. The fourth patient (No. 2), fifty-eight years old, died of "coma" at the end of seven days; the fifth (No. 6), of "continued fever" at the expiration of a year, the parts being unhealed; in the sixth (No. 37), the cause of death is not mentioned.

The 8 cases unsettled as to their result were in the following condition, respectively:—

1 after 4 months, doubtful if the hand would be saved.
1 after 45 days left the hospital, with the wound still discharging.
1 after —— was healing slowly.
1 " 8 months some prospect of motion.
1 " 1 month nearly well.
1 " 3 weeks doing well.
1 " —— doing well.
1 " —— still discharging.

In other words, 7 held out some prospect of satisfactory recovery, and one patient, at the end of 4 months, was likely to lose the hand. So that, summing up the whole, it appears that there were

14 good results; 7 unsettled as to result; 18 failures. {
6 died.
8 amputated.
3 useless hands.
1 unpromising.

Of the cases in which the result was an unfavorable one, 2 were of the right wrist, 2 of the left, and in 14 the side is not stated.

The cases given prove, I think, that the greater or less extent of the excision does not affect the result; those where only a few carpal bones were extracted doing as well as when the whole carpus, with the ends of the radius and of the metacarpal bones, was removed. And although many patients recover with useful hands, — as, for instance, in No. 16, where the patient was able to write and move his fingers in a very satisfactory manner, and in Nos. 13, 19, 28, 30, and 39, where the motion of the fingers, and in one of the wrist, was wholly regained, — still, when 18 failures are set against 14 successes, and 7 unfinished, though promising cases, with an average length of treatment in 11 of those recovering — where this is recorded — of 278 days, or more than 9 months, the operation, even if the mortality is not very great, must be one which should be performed only under exceptional circumstances.

OPERATION AND AFTER-TREATMENT.

In the dissecting-room it is by no means difficult to excise the wrist-joint, and yet respect the tendons which lie in close relationship to it; but upon the living subject it is not an easy thing to do, when these are surrounded by diseased tissues. To obviate this difficulty, Mr. Simon, of St. Thomas's Hospital, proposes and has operated by longitudinal, palmar and dorsal incisions, so that access to the joint may be had between the tendons thus separated;[1] these incisions, however, must be very long to permit of removing the bones, and the palmar one, to be of any benefit, must divide the deep flexor tendons, which, it will be remembered, opposite the articulation, are combined and not separated for the different fingers. Others, considering the preservation of tendons glued down and matted together by long disease as unimportant, have attacked the joint by a transverse or concave dorsal incision. It is doubtful if those cases in which so much pains are taken to preserve the tendons turn out more useful in their result than those performed by this last method. Mr. Stanley operated in this way, and with a very successful result (No. 5); and its success might be inferred from Cooper's and M. Hublier's cases, where, though the tendons were ruptured, the hands were afterwards used with considerable facility.

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[1] Lancet, Jan. 14, 1854.

Mr. Fergusson at first operated by longitudinal incisions along the ulnar and radial borders of the wrist, but subsequently considered a single one of tolerable length, along the ulnar side, to be sufficient; especially as that on the radial side must, almost of necessity, cut off the radial artery where it winds round the head of the metacarpal bone of the thumb.[1]

Mr. Butcher urgently advises the preservation of the trapezium and the extensor tendon of the thumb.[2] The trapezium, it is true, has a separate synovial cavity at its articulation with the metacarpal bone, and mobility of the thumb is doubtless of great importance; but, under the circumstances, just how much its preservation, or that of the tendon, will contribute to this end, requires more proof than the single successful case (No. 16) which the Dublin surgeon adduces.

The saw is almost inapplicable to this excision, and diseased bone is most easily extracted by strong forceps, or eaten away piecemeal by the gouge-forceps; this may often be done by simply dilating already existing fistulæ, without any formal incisions.

Subsequently to the operation, the fingers, as well as the thumb, should be kept semi-flexed, so that, if any motion is retained, their approximation may be more easily accomplished.

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[1] Pract. Surg., (4th ed., Lond.,) p. 294.

[2] Dublin Quarterly Journal, Nov. 1855.

The after-treatment in other respects is conducted upon general principles.

DISSECTIONS.

THE preparations in museums encourage the hope that in many instances Nature will effect a result almost, if not quite, equal to any following the most successful operations. Specimens of complete anchylosis of the carpus are to be found in the Warren Museum, Boston, as well as in those of Berlin and Leyden, the Royal College of Surgeons, Bartholomew's and Guy's Hospitals.[1] These certainly indicate that reparative processes may be set up, sufficient in some cases for the preservation of the limb without an operation.

Karl Textor examined the parts in an arm which he amputated eighty-four days after the excision of the entire carpus. The cavity left by the removal of the bones was filled with red granulations, whilst its walls were formed by the remains of the ligaments and the soft parts. The ulnar and median nerves terminated in the cicatricial mass by slight swellings. The tendons were intact, the deep flexors being united with the periosteum of the metacarpal bones and the cicatrix of the wound. Two other cases of dissection are mentioned by Mr. Holmes in his translation of Wagner, where also the above case is recorded,[2] but their details amount to absolutely nothing. These three are all of which I have any knowledge.

It appears from one of Schillbach's cases, that a compensatory enlargement sometimes occurs in the end of the ulna to make up for the bones removed by the excision, the styloid process of this bone being enlarged threefold, and causing a lateral displacement of the hand.[1] This latter deformity was also apparent in the patient whose case is reported by Champion, and who operated on himself for necrosis of the end of his radius; the want of support for the carpus having pulled the hand away from the ulna, and given it a most unfortunate twist. A tendency to the same thing was also manifested in a case of excision of the ends of the radius and ulna, operated on, in 1857, by a Russian surgeon named Scymanowsky.[2]

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[1] Cyclop. of Anat. and Phys., Art. *Wrist.*

[2] New Sydenham Soc., Vol. V. pp. 138, 237.

CONCLUSIONS.

It may be concluded from what has preceded, —

First. That the earliest excision of the wrist-joint was a partial one, (complete excision, even in subsequent times, being an exceptional event,) performed by Mr. Cooper of Bungay, England, some time previous to 1758.

Second. That, in the present state of our knowledge, excisions of the wrist-joint, whether partial or complete, being followed by a large proportion of failures, requiring a very long treatment, and, when successful, the usefulness of the hand being so limited, are operations not sanctioned by sound judgment or conservative surgery.

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[1] Beiträge zu den Resectionen der Knochen, (Jena, 1859,) p. 223.

[2] Heyfelder, Operationslehre und Statistik der Resectionen, (Wien, 1861,) p. 263.

SMALL JOINTS OF THE HAND.

I KNOW of only two instances of the excision of a metacarpo-phalangeal articulation for injury, although others have doubtless occurred. In the first, a ramrod, shot through the hand, had broken off the head of the third metacarpal bone; this was removed, and two months afterwards the patient was discharged with perfect use of the finger, though it was shortened to the length of the index and ring fingers.[1] In the second case the injury was from a circular saw. The joint of the index-finger was comminuted, but, the tendons being left intact, excision was performed in preference to amputation. The operation was followed by grave accidents, but terminated in recovery at the end of fifteen months; the finger regained complete mobility, good strength and sensation, and was shortened only three fourths of an inch.[2]

In four cases of excision for caries, performed by Fricke of Hamburgh, three of which were practised upon the metacarpal joint of the thumb, and the other upon the metacarpal joint of the middle finger, three were successful. Two of those where the joint of the thumb was excised resulted in the complete restoration of its usefulness; and the patient, the joint of whose middle finger was removed, was fast improving when he left the hospital. In the remaining case the wound healed slowly, and the patient was discharged at the end of three months in rather an unsatisfactory state.[3]

In another case, where the head of the metacarpal bone of the index-finger, together with that of the corresponding phalanx, was excised for disease, retraction had taken place to a level with the last joint of the middle finger three years afterwards, and some mobility existed at the point of excision; active motion was slight, but passive was greater. The hand was a useful one in the patient's work as a laborer.[1]

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[1] Schillbach, *op. cit.*, p. 235.

[2] Petruschky, De Resect. Artic. Extrem. Sup., p. 37.

[3] Dublin Quarterly Journ., May, 1837, p. 417.

A condition such as that last described is probably as favorable as any likely to result from excision of the metacarpo-phalangeal articulations. The cases of Fricke are obviously reported too soon to be of much value. Both here and in the phalangeal articulations the contingency of anchylosis is to be considered, and the patient's profession taken into account. The tendons must almost inevitably become involved in the inflammatory and suppurative processes which ensue upon the injury or the excision, and either slough away, or remain so adherent that no mobility, effected merely by passive flexion of the false joint, can be of any use to the patient. The operation may leave a finger enabling a clerk to hold a pen, but one which would be in the way of a carpenter every time he used his saw or his plane, and perhaps finally lead him to solicit its amputation.

Excision of the ends of the phalangeal bones of the fingers in compound dislocations is a comparatively frequent operation, their reduction being sometimes accomplished only by such a step. Benjamin Gooch appears to have been among the first to adopt this course, he having thus operated upon the thumb of a seamstress in the middle of the last century.[2]

Even here, as in the larger joints, reduction without excision seems to be not unattended by danger, since in three cases thus treated by Cramer,[3] Dickenson,[4] and Dr. Norris of Philadelphia, tetanus ensued, and in one of Samuel Cooper's, death took place within a week of the reduction, from the violence of the inflammation which followed.[1] Intense inflammation of the whole fore-arm, sloughing, and finally amputation of the thumb, not infrequently occur. Sanson, Hey, Seutin, and others, speak of such cases. Malgaigne, however, in condemning operative interference, attempts to show that these occurrences are due rather to the lateness of the date, after the dislocation, at which reduction was effected. The accident itself, as well as the operation, undoubtedly tends to the development of grave sequelæ; but there is as little doubt, that excision, though often unnecessarily performed, is far better practice than either amputation or non-reduction.

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[1] Schillbach, *op. cit.*, p. 228.

[2] Cases and Pract. Remarks in Surg., (2d ed., Norwich, 1767,) Vol. II. p. 324.

[3] O. Heyfelder, *op. cit.*, p. 59.

[4] Med. Times and Gaz., 1857, p. 229.

Motion in the metacarpo-phalangeal joints, or in those of the proximal phalanges, is of more importance than in the other articulations; for if the proximal joint be stiff, no amount of motion in the distal can be of service; but if the proximal joint can be bent, a very small degree of mobility in the distal makes the finger a useful one.

[8] Am. Journ. of Med. Sc., Jan. 1843, p. 16.

EXCISIONS OF THE LOWER EXTREMITY.

HIP-JOINT.

HISTORY.

In 1730, John Daniel Schlichting dilated a fistulous opening over the hip of a young girl, aged fourteen, long the subject of hip-disease, and through it extracted the whole head of the femur; the recovery was complete, and, to quote from his report, "sex septimanarum curriculo consolidat ut puella postmodum libere liceat manca incesserit."[1]

The first suggestion, however, of excision of the hip-joint is to be found in the Philosophical Transactions of the Royal Society of London for the year 1769, where Mr. Charles White of Manchester records the fact, that he has frequently "made an incision on the external side of the hip-joint, and continued it down below the great trochanter, when, cutting through the bursal ligament and bringing the knee inwards, the upper head of the os femoris hath been forced out of its socket and easily sawed off." "I have no doubt," he goes on to say, "but this operation might be performed on the living subject with great prospect of success."

In 1783, Mr. Joseph Brandish published a case where the head of the femur, shattered by a charge of shot, exfoliated away in fragments, and recovery ensued.[2]

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[1] Phil. Trans., Vol. XLII. p. 270.

[2] Lond. Med. Journ., Vol. VII. p. 138.

Allusion has already been made to the experiments of Vermandois (p. 3), performed upon animals in 1786, which were undertaken with a view to the substitution of excision for disarticulation at the hip.

In 1816, Schmalz, of Pirna in Saxony, imitated successfully the example of Schlichting, in a case of similar character.[1]

Yet with these repeated hints, no real excision of the joint, or of the head of the femur, appears to have been performed until April, 1822, when Mr. Anthony White, of Westminster Hospital, London, (whose name is often confounded with that of Mr. Charles White above referred to,) successfully removed the head and neck of the femur from a boy nine years old.[2]

In 1823, the operation was performed by Mr. Hewson, of Dublin;[3] in 1829, by Oppenheim, for a gun-shot wound;[4] in 1832, at the siege of Antwerp, by M. Seutin;[5] in 1834, by Kajetan Textor;[6] in 1836, by Sir Benjamin Brodie;[7] and in 1838, 1839, and 1845, again by Textor.[8]

In 1845, it received an impetus from its adoption by Mr. Fergusson of London, the influence of whose position and example has made it during the last fifteen years a comparatively frequent operation. "Whatever merit or demerit," he says, "there may be regarding its revival in this country, since Anthony White's case, must be attributed to me."[9]

In February, 1847, it was performed for the first time in France, by M. Roux.[10]

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[1] S. Oppenheimer, Ueber die Resection des Hüftgelenkes, (Würzburg, 1840,) p. 21.

[2] South's Chelius, Vol. II. p. 979.

[3] W. Hargrave, Syst. of Op. Surg., (Dublin, 1831,) p. 514.

[4] Gaz. Méd., 1835, p. 183.

[5] A. Paillard, Rélation Chirurg. du Siége d'Anvers (Paris, 1832).

[6] Karl Textor, Der zweite Fall von Aussagung des Schenkelkopfes, u. s. w., (Würzburg, 1858,) p. 15.

[7] Med.-Chir. Trans., Vol. XXVIII. p. 526.

[8] Textor, *loc. cit.*

[9] Lancet, Aug. 14, 1852.

[10] Gaz. des Hôp., Mar. 9, 1847.

In the United States, Dr. Henry J. Bigelow of Boston first excised the head of the femur, February 21, 1852.[1]

The head of the femur has been excised for gun-shot injuries, and, either alone or with more or less of the acetabulum, for disease; also, it is said, a single time, by Carmichael, of Dublin, for "medullary sarcoma," the patient, a young woman, dying the next day. There is some doubt, however, as to the authenticity of this case.[2] It has also been excised once, or perhaps twice, for deformity. For the operations performed by J. R. Barton, November 22, 1826,[3] K. Rodgers in 1830,[4] Maisonneuve in 1847,[5] and J. C. Warren in 1849,[6] were not excisions of the joint, but sections of the shaft of the femur for the establishment of a pseudarthrosis. These cases are thus particularly referred to, because foreign writers constantly allude to them as excisions.

EXCISION FOR INJURY.

INSTANCES of excision of the head of the femur for traumatic cause are few in number. The earliest is that reported by Oppenheim, and performed at the battle of Eski-Arna-Utlar, between the Russians and Turks, on the 5th of May, 1829, for a gun-shot wound, with fracture of the head and neck of the femur and of the upper edge of the cotyloid cavity; the soft parts were little injured, and the nerves and large vessels untouched. Everything went on well after the excision until the seventeenth day, when, "frightened by a case of the plague which entered the hospital and could not be concealed from him, the patient died in twenty-four hours of true typhus."[1]

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[1] Am. Journ. of Med. Sc., July, 1852.

[2] South's Chelius, Vol. II. p. 978. Oppenheimer, *op. cit.*, p. 24. Dublin Quarterly Journ., Vol. II. p. 436.

[3] N. Am. Med. and Surg. Journ., 1827, p. 292.

[4] Am. Journ. of Med. Sc., Feb. 1840.

[5] Arch. Gén. de Méd., 4^{me} série, Tom. XXV. p. 539.

[6] Boston Med. and Surg. Journ., May 17, 1855.

In Dr. O'Leary's successful case, the only one upon record, the patient, whilst on duty in the trenches before Sebastopol, on the 19th of August, 1855, had been struck over the great trochanter of the left femur by a fragment of an exploded shell. A fracture was produced, which commenced close to the head of the bone, and extended downwards and forwards between the two trochanters, terminating about an inch and a quarter below the lesser. The external wound was small. The head of the femur and the trochanters were removed. In twelve weeks the man left his bed on crutches. At the end of six months he had gradually regained the use of his limb, and, some time afterwards, was seen in London, in excellent health.[2]

But ten cases of excision for injury have been reported in print, and all of these were for gun-shot wounds.

Surgeon.	Result.	Authority.
Oppenheim.	Died on 17th day.	Gaz. Méd., 1835, p. 183.
Seutin.	" 9th "	Gaz. des Hôp., 9 Mars, 1847.
Schwartz.	" 7th "	Statham's Esmarch, p. 94.
Crerar.	" 15th "	Guthrie's Comment., 5th ed., p. 622.
Hyde.	" 6th "	Surg. of the Crimean War, p. 344.
Coombe.	" 14th "	Ibid.
Macleod.	" 7th "	Ibid., p. 338.
Blenkins.	Died during 5th week.	Ibid., p. 341.
O'Leary.	Recovered in 6 mos.	Lancet, July 12, 1856.
Baum.	Died in 22 hours.	Dr. Fock's table, Case No. 37.

The deaths in the above cases were due in two instances to causes not connected with the operation, viz. to the plague and to cholera, twice to pyæmia, twice to exhaustion, and once to gangrene. In two of them no cause is assigned.

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[1] Gaz. Méd., 1835, p. 183.

[2] Lancet, July 12, 1856. Guthrie's Commentaries, 5th ed., p. 77.

The extent of injury, and the condition of the parts after a gun-shot wound of the hip-joint, are as notoriously difficult to determine as the cases are certain to terminate fatally. Even when the upper part of the femur has been shot through, shortening, rotation outwards, and crepitus are not always present, and sometimes a very considerable power of flexion and extension remains. "Picture to yourselves," says Mr. Guthrie, "a man lying with a small hole either before or behind in the thigh, — with no bleeding, no pain, nothing but an inability to move the limb, to stand upon it, — and think that he must inevitably die in a few weeks, worn out by the continued pain and suffering attendant on the repeated formation of matter burrowing in every direction, unless his thigh be amputated at the hip-joint, or he be relieved by the operation of excision, which, I insist upon it, ought first to be performed."[1]

The chances of recovery after amputation at the hip-joint, in military practice, may be inferred from the statement that the operation was performed by the English 14 times, and by the French 13 times, in the Crimea, without a single recovery;[2] and in the Schleswig-Holstein campaign 7 times, with but one successful result.[3]

In such a condition of things, which alternative is to be adopted? By following an expectant course and trusting to the resources of nature, an almost invariable mortality will ensue. A case occurring at the battle of Solferino, diagnosticated as fracture of the neck of the femur, and another seen at Nantes in 1830 by M. Boinet, are the only recoveries I am aware of which have followed gun-shot wounds of the hip-joint.[4] On the other hand, it is as rare for amputation to succeed, or for patients to survive more than a day or two after its performance, except in civil hospital practice. The sole remaining resource, the operation of excision, has at least the advantage of not putting life in immediate danger, since one of the patients in the cases just recorded lived 5 weeks, others from 6 to 17 days, and only one so short a time as 22 hours.

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[1] Commentaries, (5th ed.,) p. 77.

[2] Macleod, *op. cit.*, pp. 338, 435.

[3] Statham's Esmarch, p. 94.

[4] L'Union Médicale, 28 Juin, 1860.

The operation, therefore, merits further attention from the military surgeon, and offers an additional chance of saving life in an otherwise almost hopeless class of cases. This is the proper aspect of the question; and the Crimean experience, so far as it goes, is conclusive on the point. The uselessness of the limb left (if it is useless) is a point of minor consideration.

Upon the general principles already alluded to (p. 5), excision ought to be the treatment demanded by that rare accident, compound dislocation of the hip-joint. Referring to the remarkable case of this kind reported by Dr. W. J. Walker of Charlestown, Mass., Dr. Hamilton says: "Had the head of the femur been resected before its reduction, I cannot doubt but that the unfortunate man's chances of recovery would have been greatly improved."[1]

Excision has also been suggested as applicable to another class of injuries described by Brodie;[2] viz. wrenches of the hip-joint, where death threatens and usually occurs within a week, preceded by a deposit of pus inside the capsule, and accompanied by coma and delirium. Mr. Henry Hancock once examined the parts after a death taking place in this manner. In the joint there was a table-spoonful of fetid pus and blood, and a longitudinal rent existed in the capsule. He remarks that he was strongly impressed with the conviction that, if the operation of excision had been performed, the patient's life might have been saved.[3]

The impossibility of a diagnosis of sufficient accuracy to warrant an operation so disastrous as this has proved itself to be, must, it seems to me, settle the propriety of its performance under these circumstances.

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[1] Fract. and Disloc., p. 724.

[2] Dis. of Joints, (4th Am. ed.,) p. 74.

[3] Lancet, April 25, 1857.

EXCISION FOR DEFORMITY.

THE case previously alluded to as coming under this head is that of Anthony White; it has always passed as a successful operation for hip-disease, whereas in reality it was for the deformity resulting from an *arrested* hip-disease. It is distinctly stated in the operator's own account,[1] that the "formation of fresh abscesses had for some months ceased, and further diseased processes were not apprehended," and that the condition of the boy's health did not forbid the operation. The knee of the affected limb was immovably fixed on the inner side of the opposite thigh, and the examination of the parts removed showed very slight, if any, proof of existing disease. The patient recovered, and, twelve months afterwards, "enjoyed a most useful compensation for the loss of the original joint; had perfect flexion and extension of the thigh and every other motion, except that of turning the knee outwards. The limb, of course, remained shorter by as much as had been cut off from the top of the thigh-bone."

There seems some probability that the excision performed by Mr. Hewson of Dublin, usually stated to have been for caries, was also for this cause. The case does not appear ever to have been reported, and the various brief references to it are as inconsistent as they are numerous. One of the most authentic appears to be that of Mr. Carte, who, at a meeting of the Dublin Pathological Society, stated that he had personal knowledge of the case, and that the operation was performed on account of "malposition from an old dislocation, with displacement upwards and backwards," the patient surviving its performance several months, and then dying of profuse suppuration, coexisting with a perforation of the cotyloid cavity.[2]

The cure of an anchylosis by means of excision was

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[1] South's Chelius, Vol. II. p. 979.

[2] Dublin Med. Press, April 28, 1841.

attempted in 1847 by Maisonneuve of Paris; but, after sawing through the bone, no efforts with chisel or gouge could dislodge its head from the acetabulum. The operation, therefore, resolved itself into what is called "Barton's," and, as such, was successful in straightening the limb, previously flexed; but eighteen months afterwards no false-joint had been obtained.[1] A similar experience, but followed by a rapidly fatal result, recently occurred in an operation for anchylosis, following an injury from blasting five months previous, performed by Dr. Peters at the New York Hospital.[2] In this case, however, the bone was sawed across below the trochanters and through the neck, and the segment thus included removed. The efforts to extract the head of the bone were unavailing.

The two instances given, admitting them to have been operations for deformity,—of which there is some doubt,—hardly warrant generalization as to the propriety of excision in similar cases.

EXCISION FOR DISEASE.

SETTING aside the question of its applicability to malignant affections of the upper part of the femur, as unworthy of consideration, necrosis and "hip-disease" present themselves as the only conditions in which excision is to be thought of as a method of remedial treatment. It should, however, be said, that the end of the femur has been removed three times for chronic rheumatic arthritis by Messrs. Shaw, Morris, and Fock;[3] but, as in two of these cases the operation would probably not have been undertaken had the condition of the joint been fully appreciated, it is perhaps unnecessary to consider it in relation to this form of disease.

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[1] Arch. Gén. de Méd., 4^{me} série, Tom. XXV. p. 539. Comp. de Chir., Tom. II. p. 475.

[2] Am. Med. Times, April 20, 1861.

[3] Lancet, Oct. 18, 1856, and Aug. 14, 1852. Arch. für Klin. Chir., Band I. Heft I. p. 182.

As an instance of the operation for necrosis, and the only one I am acquainted with, that performed by the elder Textor on the 31st of July, 1834, may be cited. A little boy, seven and a half years old, fell on his great trochanter; within a few weeks a swelling and abscess formed, and on opening this the trochanter and part of the neck of the bone were felt to be denuded. The incision already made being enlarged, a fracture through the cervix was found, and although the bone appeared to be necrosed below the lesser trochanter, the saw was applied above that process in order to preserve the muscular attachments. Suppuration, bedsores, and gangrene ensued, and the patient died on the twenty-third day after the operation.[1]

As a matter of curiosity, the case of Mr. Brandish is perhaps deserving of further mention in this connection. On the 23d of September, 1783, a lad, twelve years old, received a charge of shot from a gun, the whole of which passed through the upper part of the thigh and came out about the middle of the gluteus maximus. The orifice of entrance was about the size of a shilling-piece, that of exit somewhat larger. The surgeon "contented himself with injecting spirit of turpentine and linseed-oil, warm, into the wound by means of a syringe, and afterwards covering the wounds with a large poultice of bread and milk." In the course of his attendance several exfoliations of bone came away, one, in particular, which appeared to be a considerable portion of the head of the femur with a shot sticking in it. October 5th, 1785, the boy walked tolerably well with the assistance of a crutch.[2]

From two cases such as these, conclusions are not to be drawn, and in similar instances general principles must prevail as to the course to be pursued.

[1] Gaz. des Hôp., Mar. 9, 1847.

[2] Lond. Med. Journ., Vol. VII. p. 138.

The diagnosis of the existence, or of the precise condition, of hip-disease, (only a little less frequent, according to the statistics of Guy's Hospital, than disease of the knee,[1]) is often obscure and difficult. The advanced stages of lumbar abscess, caries of the os innominatum, and of the great trochanter and neck of the femur, have been mistaken for it; and the shortening of absorption, the distortion of the pelvis, and the carrying of the limb across its fellow, have also been mistaken for the symptoms of a spontaneous dislocation, which did not exist. Mr. Fergusson, of London, after commencing an operation upon a young girl of nineteen, — who for sixteen years had suffered from hip-disease, — with the intention of removing the head of the femur, supposed to be carious as well as dislocated, found it in its place, firmly attached to the cotyloid cavity by anchylosis; the succession of large abscesses about the hip and upper part of the thigh, which had induced him to operate, depending upon a disease of the trochanter major.[2]

The difficulty in diagnosticating the precise condition of the parts is also well shown by three cases alluded to in the Medical Times and Gazette for September 1, 1858. In one, on exposing the joint, the bone rotated in its socket without perceptible grating, and the finger discovered no carious surface. At length, an opening in the capsular ligament was detected; on enlarging this and turning out the head of the bone, it was found to be wholly denuded of cartilage, but so protected by soft granulations that no grating was produced. In the second, much embarrassment was caused by a similar state of things; and in the third case the surgeon abandoned the operation, fearing lest he should open a healthy articulation.

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[1] Bryant, Dis. and Inj. of Joints (Lond. 1859).

[2] Lancet, April 15, 1848, p. 415.

The application of surgical treatment to caries of the trochanter major appears to be followed by very fair success, whenever portions of it or of the cervix femoris are removed without opening the capsular ligament. Of ten operations of the kind performed by Tenon (Champion, Tr. de la Résect., etc., p. 65), Liston (Med. Times, June 18, 1851, p. 689), Fergusson (Lancet, April 15, 1848), Erichsen (Med. Times and Gaz., March 17, 1860), J. F. Heyfelder (Ueber die Resection, u. s. w., p. 160), Textor, d. s. (O. Heyfelder, Operationslehre, u. s. w., p. 92), Parker (Gross. Syst. of Surg., Vol. II. p. 1101), and Velpeau (Gaz. Méd., No. 3, 1837), eight resulted in recovery.

Another important question, raised in connection with excision of the hip-joint, has reference to the condition of the acetabulum, and the propriety of operating when this is diseased.

There are those who maintain, that, without waiting for healing processes to take place in the cotyloid cavity, and however much it may be diseased, the operation of excision may still be performed. In the autumn of 1833, Heine and Jaeger demonstrated upon the dead subject the feasibility of removing the head of the bone and the whole acetabulum, without wounding the pelvic fascia or the peritoneum.[1] Mr. Henry Hancock has also attempted to show, that the pelvic organs can in no way be injured by manipulations practised on the acetabulum, even when perforated by the disease, they being protected by the fasciæ and soft parts within the pelvis, and lifted away from the bone by the collection of pus, which forms a sort of chamber between it and the viscera. That such was the fact, and that such an operation might be performed upon the living subject, he undertook to prove by sawing out the whole acetabulum. The operation was performed on the 6th of December, 1856, and the patient, from a condition in which he could not long have survived, in fourteen days sat up in bed, the first time for a year; in three weeks dressed himself and sat by the fire; in five weeks went upon crutches; and in four and a half months walked in the Park daily.[2]

On the other hand, it is asserted that no operation is justifiable unless the acetabulum is free from disease. Mr. Henry Smith stated in 1849, that, of all the operations which had been practised in Great Britain up to that period, those only were successful in which, at the time of their performance, displacement of the head of the femur and its more or less carious condition were found to be alone the cause of all the disturbance, although disease of the acetabulum had perhaps previously existed.[1]

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[1] Oppenheimer, Ueber die Resect. des Hüftgelenkes, p. 55.

[2] Lancet, April 25, 1857.

The general opinion of pathologists is, however, that the coexistence of pelvic and femoral caries is almost constant, after the disease has fairly developed itself.

According to Mr. Hancock,[2] in 26 operations the acetabulum was found diseased 18 times, thus: —

In 2 cases scarcely a trace of the cavity.
In 3 cases filled with a fibro-gelatinous mass.
In 6 cases the gouge was used for caries.
In 1 case enlarged from absorption.
In 1 case deprived of its cartilage.
In 1 case perforated.
In 1 case partly obliterated.
In 1 case death 2 yrs. after operation from its perforation.
In 1 case death 3 mos. after operation from its perforation.

In the 133 cases which I have collected, the acetabulum, at the time of the operation, was more or less diseased in 76; not diseased in 18; whilst in 39 its condition is not stated.

The only cases in which the surgeon can hope to find the acetabulum in a healthy condition are those where the head of the femur is so much absorbed as not to lie in contact with it, or when spontaneous dislocation has for some time existed. Even in these, as will presently appear, a healthy acetabulum is of infrequent occurrence.

But it may be said that before either of these results can have taken place, the patient will die, worn out by hectic, suppuration, and exhaustion. Is the operation with its benefits, if any, to be rejected on this account? If the pelvic portion of the disease sometimes seems to recover when the head of the femur is absorbed or dislocated, why not give it an opportunity to do this by an operation?

Without entering into a discussion as to whether spontaneous dislocation ever does occur,[1] or falling back upon Mr. Syme's assertion, that caries, once established, never takes on reparative action,[2] the answer to such an argument is, that the continuous progress of the disease from bad to worse is not the only direction in which it tends. Other treatment than excision is not without avail. Mr. Smith's cases show that the acetabulum takes on reparative action with a considerable degree of readiness; a limit to the destructive processes may be set up by successful efforts at new ossific production, with gradual cessation of the discharge, the healing of fistulæ, and final anchylosis. Preservative surgery may thus take the place of the more heroic conservative methods. The results of the former are as likely to be serviceable as those of the latter, and the chance of success which it offers is as great as that of an operation of which one of the contingencies is, that it may destroy life immediately. Half the irritation of the disease may be arrested at once by an apparatus for extension,—a method of treatment, the principles of which are sustained by those on which the practice of excision is based. Mr. Holmes Coote says,—and that too after the satisfactory experience of a successful case of excision under his own care,—that he should try extension, "not for weeks, nor even for months, but for years, before resorting again to so serious an operation as resection of the hip-joint, which, however successful in its issue, leaves the patient in a crippled state for at least an equal period of time, and which likewise shows, in a large proportion of cases, a fatal result."[3]

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[1] Lancet, March 17, 1849.

[2] Ibid., April 18 and 25, 1857.

In those grave cases where it might be urged that an operation affords the only chance of saving life, it must be remembered that it is not the articular symptoms which usually cause death, but rather the exhaustion produced, not by resistance to an incurable local disease, but by the general constitutional state, of which the local condition and the exhaustion are both only the symptoms; and to whatever extent the local trouble may aggravate the general symptoms, as it is not the cause of those symptoms, so neither will its removal prove the remedy.

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[1] Trans. of the Am. Med. Assoc., Vol. VI. p. 479.

[2] Lancet, May 5 and June 9, 1849.

[3] Brit. Med. Journ., July, 1858.

Having thus reviewed some of the most important features of hip-disease as they bear upon the question of operative interference, before passing to the consideration of collected cases and the conclusions to be derived from them, it may not be uninteresting to note the results which have been arrived at by other writers on this subject.

In 1848, according to a paper read by Mr. Henry Smith, before the Medical Society of London, only 16 cases of excision of the head of the femur had at that time been published; in these there were 8 deaths and 8 recoveries.[1]

In 1849, Santesson, of Stockholm, published a table of 20 cases, 10 of which were successful, and 10 fatal.[2]

In 1857, Mr. Henry Hancock stated that, of 26 operations performed in England, 6 proved fatal within three months; in 3 cases, one patient lived two years, another six months, and the third four months; in 2 cases, the result was not known; in 15 there was a perfect cure.[3] In the same year Mr. Erichsen says, that, so far as he can learn, the head of the femur has been excised 38 times, with 14 fatal results;[4] and Mr. Fergusson expressed his opinion of the operation in these words: "I have now no hesitation in stating my opinion, that in properly selected cases the operation will prove eminently successful in saving life."[5]

In February, 1860, Mr. Price read a paper before the London Medical Society, giving an analysis of 59 cases, 33 of which had proved "quite successful," and 11 partially so; i. e. the patients had been benefited, both locally and constitutionally, living for periods varying from three months to two years, death occurring more from other causes than from a recurrence of the disease which demanded the operation. The operation was, more or less directly, the cause of death in 14 cases. In one case the ultimate result was not known.[6]

[1] Lancet, April 15, 1848.

[2] Dublin Quarterly Journ., Vol. XI. p. 432.

[3] Lancet, April 18, 1857.

[4] Sc. and Art. of Surg., 2d ed., p. 680.

[5] Pract. Surg., 4th ed., p. 467.

[6] Med. Times and Gaz., Feb. 25, 1860.

In June, 1860, Dr. Lewis A. Sayre, of New York, presented a report on Hip-disease to the American Medical Association, connected with which was a table of 110 excisions, of which 36 were reported as terminating fatally, 2 unfavorably, and 72 in recovery, with a more or less useful joint.[1]

The first number of the Archiv für Klinische Chirurgie,[2] contains a table by Dr. C. Fock, of Magdeburg, comprising 79 excisions for disease, in 36 of which there was a fatal result; 40 were completely or almost cured, and 14 were uncertain as to their issue. In 32 of the 40 recoveries, the use of the limb was completely regained; in 9, imperfectly regained; and in 9, "the observations were published at a time when nothing could be affirmed as to the result." In 35 cases where the acetabulum was gouged, there were 17 recoveries, 11 deaths, and 7 doubtful results. In 32 cases where spontaneous dislocation had occurred, there were 16 recoveries, 9 deaths, and 7 doubtful results.

Mr. R. Barwell gives 92 excisions for disease, with 56 recoveries, 32 deaths, and 4 uncertain results. In 36 of the above recoveries, the limb was reported as useful; in 6, as useless; whilst in 14 no reliable information could be obtained beyond the fact of recovery.[3]

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[1] Trans. of Am. Med. Assoc., Vol. XIII. p. 469.

A certain amount of reserve is necessary in receiving the results of this table, as some inaccuracies have unfortunately crept into its compilation. Thus, Case 11 is an instance of "Barton's operation"; Nos. 1, 41, 69, of removal of the spontaneously separated head of the femur; and Nos. 4, 23, 57, 97, are operations for necrosis or rheumatic arthritis, and not for hip-disease; whilst Nos. 9 and 18, 15 and 16, 52 and 65, 60 and 89, are repetitions of each other. Sixteen cases, viz. Nos. 36, 37, 45, 49, 58, 60, 61, 66, 68, 75, 76, 84, 101, 104, 105, and 106, not having reached a definite result, — seven of them having been under treatment less than six weeks, and none more than three months, — can hardly with fairness be considered recoveries. And the want of reference to authority for numerous cases, especially Nos. 25, 50, 51, 90 (that given not being correct), and 93, is certainly an omission in a table otherwise so complete in this respect. It is to be regretted that Dr. Sayre has not furnished his excellent article with a more elaborate analysis of the cases which accompany it.

[2] Herausgegeben von Dr. B. Langenbeck, Berlin, 1860.

[3] Treatise on Diseases of the Joints, (London, 1861,) p. 438.

It seems proper to make a distinction between those cases where the head of the bone, already spontaneously separated, is removed, and those in which the separation is effected at the time of the operation. The former resemble operations for necrosis, and admit of less doubt as to the propriety of the course pursued.

From a variety of sources, 21 instances of removal of the head of the femur, spontaneously separated from the rest of the bone, have been collected.

Surgeon.	Result.	Authority.
Klinger.	Recovered.	Arch. für Klin. Chir., Bd. I. s. 213.
Schlichting.	" 6 weeks.	Philos. Trans., Vol. XLII. p. 284.
Shaw.	"	Dublin Quarterly, Vol. XV, p. 290.
Schmalz.	" 3 years.	Oppenheimer, p. 21.
Batchelder.	"	Am. Med. Month., Apr. 1859, p. 379.
Batchelder.	"	N. Y. Med. & S. Rep., Jan. 10, 1846.
Carlisle.	"	Dublin Quarterly, Vol. XV. p. 290.
Vogel.	" 3 mos.	Sédillot, Méd. Op., T. I. p. 511, 2d ed.
March.	"	Am. Med. Times, July 14, 1860.
March.	"	Ibid.
Huntington.	"	Catal. of Warren Mus., No. 1147.
Bowman.	" 2½ mos.	Med. Times and Gaz., Sept. 1, 1860.
Ried.	Died in a year. Bright's dis.	Arch. Gén. de Méd., [5.] T. II. p. 720.
Simon.	Died in a few days. Phthisis.	Lancet, Oct. 17, 1857.
Harris.	Recovered in 2 years.	Philad. Med. Ex., Vol. II. p. 38.
Kirkland.	Recovered.	Arch. für Klin. Chir., Bd. I. s. 212.
Hofmann.	"	Ibid.
Schubert.	"	Ibid., s. 213.
Ohle.	Died soon after of hectic.	Ibid., s. 212.
Ross.	Died in 3 days. 2d'y Hem.	Ibid., s. 214.
Kuhn.	Died in 6 days. Bright's dis.	Ibid., s. 218.

These cases hardly require further comment than that with which they have been introduced. The separation of the bone is itself an effort on the part of nature in a curative direction; and the considerable success — which might perhaps be anticipated — attending its removal is sufficiently well shown in the above table, exhibiting, as it does, but five fatal cases, one of those having occurred after the lapse of a year from the date of the operation.

The table which follows contains the memoranda of 133 cases of excision of the head of the femur, and, in a certain number, of more or less of the acetabulum, for hip-disease.

No.	Authority.	Sex.	Age.	Result.	Duration of Treatment.
1	Oppenheimer, ueber die Resection., etc., p. 45.	M.	54	Died.	53 days.
2	Ibid., *op. cit.*, p. 41.	M.	18	“	4 days.
3	Med. Chir. Trans., Vol. 28, p. 576, and Med. Chir. Rev., July, 1846.	M.	Ad'lt.	“	A few days.
4	Med. Chir. Trans. p. 571.	M.	14	Recovered.	7 mos.
5	Med. Gaz., Dec. 1849, and July, 1850.	F.	12	Died.	6 mos.
6	Fergusson's Pr. Surg., 4th ed., p. 465, and Lancet, Aug. 14, 1852.	M.	8	Recovered.	5 mos.
7	Gaz. des Hôp., Mar. 7, 1847.	M.	15	Died.	7 days.
8	Lancet, Aug. 14, 1852.	M.	17	“	3 mos.
9	Ibid.	M.	12	“	A few hours.
10	Ibid., Apr. 15, 1848.			“	4 days.
11	Ibid., Nov. 25, and Dec. 9, 1848.	M.	33	“	5 mos.
12	Lancet, Jan. 22, and Apr. 7, 1849.	F.	10	Recovered.	2½ mos.
13	Med. Times and Gaz., Nov. 13, 1852.	F.	32	“	8 mos.
14	Lancet, Feb. 28, 1852.	F.	8	Died.	3 days.
15	Ibid., Jan. 21, 1854.	M.	8	Recovered.	18 mos.
16	Brit. Med. Journ., Jan. 2, 1858, Med. Times and Gaz., Feb. 20, 1858, and Lancet, Apr. 13, 1861.	M.	16	“	4 mos.
17	Records Bost. Soc. for Med. Imp., Vol. I. p. 226.	M.	11	Died.	10 days.
18	Glasgow Med. Journ., Vol. I. p. 10.	M.	41	“	4 mos.
19	Lancet, Jan. 30, 1858.	F.	26	“	8 days.
20	Ibid., Mar. 20, 1858, and Nov. 26, 1859.	M.	8½	Recovered.	6½ mos.
21	Med. Times and Gaz., Mar. 28, 1857.	F.	26	“	34 mos.
22	Ibid., Apr. 21, 1860.	M.	10	Died.	3 mos.
23	Mass. Gen. Hosp. Records.	M.	9	“	16 days.
24	Lancet, May 5, 1860.	M.	11	“	20 days.
25	J. F. Heyfelder, Ueber Resect. und Amp., p. 155.	M.	20	Amp. Died.	12 mos.

Condition of Parts and Extent of Excision.	Remarks.
Bone not disloc. Acetab. healthy. Cut off 2 in. below trochanters. R. hip.	Death from bed-sores.
Bone disloc. Acetab. cauterized. Head alone removed. Left hip.	Death from diarrhœa.
Bone not dislocated.	Death from the operation.
Bone disloc. Acetab. not touched; 4½ in. removed. Left hip.	Eventually able to walk 20 miles in a day.
Bone disloc. Acetab. not diseased. Cut off below trochanters. Right hip.	Death from double psoas abscess.
Bone disloc. Acetab. not diseased. Head and neck removed.	About on crutches; wound unhealed. Died 2 yrs. after op. of dis. of liver.
Bone disloc. Acetab. not diseased. Head and neck removed. Left hip.	Death from secondary hemorrhage.
Head of bone absorbed. Acetab. gouged. Cut off below trochanters.	Sat up in bed in 2 mos. Died in 3 mos. of general disease.
Bone not disloc. Acetab. diseased. Head and neck removed.	Death from hemorrhage. Profunda vein opened by an abscess.
Bone disloc. Acetab. gouged. Head and neck removed.	Almost dead when operated on. Patient was a child.
Bone disloc. Acetab. gouged. Cut off below trochanters. Left hip.	Death from great local and general disease. Lumbar vertebræ carious.
Bone disloc. Acetab. not diseased. Cut off below trochanters. Left hip.	"Wonderful amount of motion restored."
Bone disloc. Acetab. not diseased. Cut off below trochanters. Left hip.	Walks with a cane. Died a year or two after op. of visceral disease.
Bone disloc. Acetab. gouged. Cut off below trochanters.	Death from hemorrhage.
Bone disloc. State of acetab. not mentioned.	About on crutches, but parts not cicatrized.
Bone disloc. Acetab. healthy. Head and trochs. removed. Right hip.	Considered by the operator at first to be a very successful case. Subsequently, limb as useless as before op.
Bone disloc. Acetab. diseased, but not gouged. Head and neck removed. Left hip.	Death from exhaustion.
Bone disloc. Acetab. gouged. Head and neck removed. Right hip.	Death from general disease and diarrhœa.
Bone not disloc. Acetab. gouged. Cut off below trochanters. Portion of ischium excised. Right hip.	Death from erysipelas.
Bone not disloc. Acetab. gouged. Cut below trochanters. Left hip.	Bears entire weight of body. Plays with other boys.
Bone not disloc. Acetab. gouged. Cut off below trochanters. Left hip.	Eventually walked with a cane.
Bone disloc. Acetab. gouged. Head alone removed. Left hip.	Death from exhaustion and suppuration.
Bone disloc. Acetab. not diseased. Head and neck removed. Left hip.	Death from exhaustion.
Bone not disloc. Head alone removed. Right hip.	Death from exhaustion.
Partial disloc. Acetab. gouged. Actual cautery applied. Head and neck removed. Left hip.	Got about on crutches; at end of a a year caries returned; at end of 3½ years, amputation, and removal of 2½ inches of horizontal ramus of pubes. Death 2 hours after operation, from the shock.

No.	Authority.	Sex.	Age.	Result.	Duration of Treatment.
26	Mass. Gen. Hosp. Records.	M.	12	Died.	10 mos.
27	Med. Times & Gaz., Aug. 8, 1857, and Lancet, Oct. 24, 1857, and May 5, 1860.	M.	5	Recovered.	10 mos.
28	Lancet, Oct. 3, 1857, and Med. Times and Gaz., Oct. 24, 1857.	M.	11	"	5½ mos.
29	Lancet, July 31, 1858.	M.	54	Died.	11 days.
30	Med. Times and Gaz., Dec. 24, 1853, Sept. 23,'54, and Lancet, Jan. 21,'54.	M.	14	"	6 mos.
31	Lancet, Apr. 25, 1857, and Barwell on Dis. Joints, p. 445.	M.	14	Recovered.	4½ mos.
32	Lancet, Apr. 15, 1848, Fergusson's Pr. Surg., 4th ed., p. 467, and Barwell on Dis. Joints, p. 449.	F.	10	"	
33	Charleston Med. Journ., May, 1857.	M.	20	Died.	30 hours.
34	New York Journ. of Med., Jan. 1855, and Am. Med. Monthly, Apr. 1860.	F.	9	Recovered.	8 mos.
35	Private letter.	M.	18	Died.	13 days.
36	Ibid.	M.	8	Recovered.	5 mos.
37	Lancet, May 5, 1860, and Medical Times and Gaz., Apr. 7, 1860.	M.	12	Died.	39 days.
38	Lancet, Oct. 17, 1857.	M.	10	"	10 weeks.
39	Schillbach, Resect. der Knoch., p. 12.	M.	11	Recovered.	13 mos.
40	Med. Times and Gaz., Apr. 21, 1860.	M.	12	"	4 mos.
41	Ibid.	M.	17	"	12 mos.
42	Lancet, Oct. 17, 1857.	M.	13	Died.	5 weeks.
43	Ibid., Oct. 24, 1857.	M.	37	"	26 days.
44	Med. Times and Gaz., May 8, 1858.	F.	23	"	4 days.
45	Lancet, Oct. 10, 1857.	M.	7½	Recovered.	6 mos.
46	Ibid., and Apr. 28, 1860, and Med. Times and Gaz., Oct. 24, 1857.	F.	5	Died.	3 mos.
47	Lancet, July 25 and Oct. 10, 1857, and Med. Times and Gaz., Oct. 17, 1857.	M.	7	Recovered.	3 mos.
48	Lancet, Jan. 26, 1861.	M.	4	"	7 weeks.
49	Ibid., Nov. 26, 1859.	F.	20	"	2 years.
50	Lancet, Feb. 14, 1852, and Med. Times and Gaz., July 2, 1853.	F.	10	"	17 mos.
51	Lancet, Apr. 15, 1848.			"	
52	Glasgow Med. Journ., 1857.	M.	8	Amputat.	4 mos.
53	Ibid., July, 1857, and Med. Times and Gaz., June 5, 1858.	M.	10	Recovered.	7 mos.
54	Beaney, Conserv. Surg., p. 7.	F.	12	"	1 year.

Condition of Parts and Extent of Excision.	Remarks.
Bone not disloc. Acetab. carious but not touched. Head and neck removed. Right hip.	Died from cough and diarrhœa, and extensive local disease.
Bone disloc. Acetab. gouged. Head and neck removed. Great trochanter gouged. Right hip.	Walks well with aid of stick.
Bone not disloc. Acetab. gouged. Head alone removed. Left hip.	Walks without crutches.
Bone disloc. and absorbed. Acetab. not diseased. Cut off below trochanters. Right hip.	Death from bed-sores.
Bone disloc. Acetab. gouged. Cut off below trochanters. Right hip.	Died, worn out by suppuration.
Bone not disloc. Whole acetab. excised with saw. Cut off below trochanters. Right hip.	Walks well with a crutch. At the end of 7 mos. phthisis, and death a year after.
Bone disloc. Acetab. not diseased. Cut off below trochanters. Right hip.	Foot ulcerated from imperfect nutrition. Can bear but a few pounds weight on the limb.
Bone not disloc. Acetab. gouged. Head and neck removed. Right hip.	Death from shock of operation.
Bone disloc. Acetab. gouged. Head and neck removed. Left hip.	7 years after op. jumps rope; motions of joint perfect.
Acetab. diseased, but not gouged.	Death apparently from pyæmia.
Bone not disloc. Acetab. gouged. Head and neck removed.	Walks and runs with a cane.
Bone not disloc. Acetab. gouged. Cut off below trochanters.	Death from diarrhœa.
Bone disloc. Acetab. gouged. Cut off below trochanters. Left hip.	Death from phthisis.
Bone partially disloc. Acetab. gouged. Head removed. Trochanter gouged. Right hip.	Walks tolerably with a cane.
Acetab. gouged. Cut off below troch'rs.	Walks fairly with a high-heeled shoe.
Head of femur alone removed. Left hip.	A good recovery.
Bone disloc. Acetab. gouged. Cut off below trochanters.	Death from phthisis.
Head and neck of bone scraped.	Death from suppuration.
Acetab. gouged. Head alone removed.	Death from exhaustion.
Bone disloc. Acetab. gouged. Cut off through the trochanters. Left hip.	Wears a leather cap over hip. Walks fairly with a high-heeled shoe.
Head of bone absorbed. Acetab. scraped. Cut off below trochanters. Right hip.	Death from valvular disease of the heart.
Bone not disloc. Acetab. gouged. Head and neck removed.	In 3 mos. bears his weight and walks round his bed.
Acetab. diseased. Cut off through the trochanters. Left hip.	No details beyond "discharged cured."
No details of operation.	In 2 years a most serviceable limb.
Bone not disloc. Acetab. diseased. Head and neck removed. Left hip.	No details as to exact subsequent condition.
"All above lesser trochanter."	"Walks and bears his weight."
Head alone removed.	Not doing well. At end of 4 mos. limb was amputated. Recovered.
Acetab. diseased.	No details as to after-condition.
Bone not disloc. Acetab. healthy. Head and 2 in. of shaft removed. Left hip.	Walks well with a high-heeled shoe.

No.	Authority.	Sex.	Age.	Result.	Duration of Treatment.
55	Liverpool Med. Chir. Journ., July, 1858, p. 252.	M.	13	Died.	6 weeks.
56	Am. Med. Times, Sept. 1, 1860, and Tr. of Am. Med. Assoc., Vol. XIII. p. 530.	M.	11	"	8 days.
57	Am. Med. Times, Sept. 8, 1860.	M.	7	Recovered.	7 mos.
58	Ibid.	M.	17	Died.	4 mos.
59	Lancet, Sept. 8, 1860.	M.		Recovered.	10 mos.
60	Ibid.	M.	8	"	8 mos.
61	Am. Med. Times, Nov. 10, 1860.	M.	6½	"	5 mos.
62	Ibid.	M.	6	"	4 mos.
63	Lancet, Nov. 24, 1860.	M.	30	Died.	2 mos.
64	Arch. f. Klin. Chir., Band I. s. 176, 179.	F.	9	Recovered.	6 mos.
65	Ibid., s. 179.	M.	14	Died.	11 weeks.
66	Ibid., s. 180.	M.	22	"	18 days.
67	Ibid., s. 185.	F.	13	"	14 days.
68	Lancet, Feb. 2, 1861.	M.	8½	Recovered.	5 mos.
69	Ibid., Jan. 26, 1861.	M.	21	"	10 mos.
70	Zeitschrift der k. k. Gesellschaft der Aertze zu Wien, 9 Janner, 1860.	M.	19	"	7 mos.
71	Ibid.	M.	21	"	4 mos.
72	Am. Med. Times, Feb. 2, 1861, and Tr. of Am. Med. Assoc., Vol. 13, p. 556.	F.	5	"	3 mos.
73	Lancet, July, 24, 1858, and Erichsen, Sc. and Art of Surgery, 3d ed., p. 745.	F.	13	"	4½ mos.
74	Lancet, Feb. 2, 1861.	F.	6	"	2½ mos.
75	Dr. Sayre's Table, No. 42.	M.	3½	"	
76	Ibid., No. 103.	M.	13	"	
77	Ibid., No. 78.	M.	27	Died.	7 days.
78	Ibid., No. 44.	M.	4	"	18 mos.
79	Ibid., No. 53.	M.	3	"	12 mos.
80	Ibid., No. 54.	F.	7	"	12 mos.
81	Ibid., No. 63.	M.	6	"	4 mos.
82	Ibid., No. 77.	M.	4½	Recovered.	
83	Dr. Fock's Table, No. 40.	M.	8	"	4 mos.

Condition of Parts and Extent of Excision.	Remarks.
Head and neck absorbed. Cut off below great trochanter. Left hip.	Death from exhaustion.
Head of bone and extensive removal of portions of ilium, ischium, and pubes.	Death from exhaustion.
Bone not disloc. Acetab. healthy. Head alone removed. Left hip.	Walks without crutches.
Head of bone absorbed. Acetab. gouged. Cut off at trochanters. Left hip.	Death from exhaustion.
Bone not disloc. Acetab. extensively gouged. Cut off below trochanters. Right hip.	No details as to exact subsequent condition.
Bone not disloc. Right hip.	About, out of doors.
Bone not disloc. Head and portions of acetabulum removed. Right hip.	Able to bear his weight. Left hospital as requiring no further surgical aid.
Bone not disloc.	Considered to have a useful limb.
Bone not disloc. Acetab. gouged. Cut off below great trochanter. Left hip.	Death from diarrhœa and exhaustion.
Bone not disloc. Acetab. gouged. Cut off below trochanters. Left hip.	On her feet most of the day. Uses a cane ordinarily; can go without.
Bone not disloc. Acetab. gouged. Head alone removed. Left hip.	Death from Bright's disease.
Bone disloc. Acetab. not gouged. Head and neck removed. Right hip.	Death from pyæmia.
Partial disloc. Acetab. cauterized. Head and neck removed. Right hip.	Death from phlebitis.
Head absorbed. Acetab. gouged. Cut off through trochanters. Right hip.	No details beyond "discharged cured."
Head alone removed. Acetab. healthy.	Walks with a stick.
Bone disloc. Acetab. not touched. Head and neck removed. Left hip.	Walks without crutches.
Bone disloc. Acetab. gouged. Cut off through the trochanters. Right hip.	Walks with a cane.
Acetab. gouged. Cut off through trochanters. Left hip.	Walks with a cane.
Upper end of femur removed, and whole acetab.; rami of pubes and ischium with part of tuber ischii and part of dorsum ilii. Left hip.	Walks with much ease.
Apparent disloc. Cut off through the trochanters. Acetab. gouged. Left hip.	"Discharged cured."
Acetab. gouged. Head, neck, and part of trochanters removed.	Has a movable false joint.
Four inches of femur removed.	No details.
Portions of ilium, ischium, and pubes removed.	
Acetab. gouged. Cut off through the trochanters.	Death from "convulsions." Wound not healed.
Acetab. gouged. Part of head and neck removed.	Death from "diphtheritic croup."
Head and neck alone removed.	Death from "uræmic convulsions and exhaustion."
Acetab. and surrounding bone gouged. Head and neck removed.	Death from "inanition and progressive caries."
Acetab. gouged. Head removed.	"Useful limb."
Acetab. not touched. Cut off through trochanters.	Walks without crutches.

No.	Authority.	Sex.	Age.	Result.	Duration of Treatment.
84	Dr. Fock's Table, No. 69.	F.	5	Recovered.	3 mos.
85	Ibid., No. 70.	F.	10	Died.	11 days.
86	Ibid., No. 76.	M.	7	"	5 mos.
87	Ibid., No. 78.	F.	8	Recovered.	
88	Ibid., No. 79.	M.	10	"	
89	Ibid., No. 80.	M.	16	"	4 mos.
90	Ibid., No. 81.	M.	21	"	12 mos.
91	Ibid., No. 88.	M.	5	Died.	8 days.
92	Ibid., No. 89.	M.	27	"	16 days.
93	Ibid., No. 34.	M.	26	Recovered.	9 mos.
94	Textor, d. j. Der zweite Fall. u. s. w., p. 6.	M.	7	"	8 mos.
95	Ibid., p. 3.	M.	17	"	6 mos.
96	Ibid., p. 11.	M.	44	Died.	10 days.
97	Ibid., p. 16.	M.	8	"	24 days.
98	Ibid.	M.	23	"	1 month.
99	Ibid.	M.	10	"	30 days.
100	Med. Times and Gaz., Apr. 27, 1861.	M.	8	"	3 mos.
101	Ibid., Aug. 24, 1861.	M.	13	Recovered.	6 mos.
102	Arch. f. Path. Anat. u. f. Klin. Med., Band XXI. Heft 3, p. 289.	F.		Died.	
103	O. Heyfelder's Table, No. 64.			Recovered.	
104	Ibid., No. 65.			Died.	
105	Private Letter.	M.	20	"	4 mos.
106	Med. Times and Gaz., Aug. 10, 1861.			"	10 weeks.
107	Private Letter.	F.	11	Recovered.	13 mos.
108	Ibid.	F.	6	"	10 mos.
109	Ibid.	M.	6	"	7 mos.
110	Ibid.	F.	13	Died.	3 mos.
111	Ibid.	M.	7	Recovered.	4 mos.

Condition of Parts and Extent of Excision.	Remarks.
Acetab. gouged. Cut off below trochanters. Left hip.	No details beyond "discharged cured."
Bone disloc. Acetab. gouged. Cut off through trochanters.	Death from exhaustion.
Acetab. gouged. Cut off below trochanters. Right hip.	Death from cerebral disease.
Acetab. gouged. Cut off below trochanters.	Walks without a cane.
Entire acetabulum and upper third of femur removed.	Requires mechanical assistance in walking.
Acetab. gouged. Cut off below trochanters. Left hip.	Walks well with crutches.
Bone disloc. Cut off below trochanters. Right hip.	Walks with a cane and a high heel.
Bone disloc. Acetab. not touched. Cut off below trochanters. Right hip.	Death from pyæmia.
Head and neck removed. Left hip.	Death from pyæmia.
Bone dislocated. Head and neck removed.	Died from phthisis three years after operation.
Cut off below trochanters. Right hip.	Earns his living as a travelling tailor.
Cut off below trochanters.	Walks with a high heel and a cane.
Right hip.	
Left hip.	Death from psoas abscess.
Left hip.	
Acetab. gouged. Head of femur and great trochanter removed.	Death from phthisis.
Acetab. gouged. Head and part of neck removed.	Walks four miles a day with a cane.
Right hip.	
	Death from erysipelas.
Acetab. gouged. Head, neck, and part of trochanter major removed. Right hip.	Death from bed-sores and erysipelas.
Acetab. gouged. Head of femur removed. Disease not wholly eradicated.	Death from exhaustion.
Head and neck absorbed. Acetab. healthy. 1½ in. of shaft removed. Right hip.	Walks with the aid of a splint.
No dislocation. Acetab. gouged. Head, neck, and great trochanter removed. Left hip.	Walks without assistance.
Acetab. healthy. Head, neck, and lesser trochanter removed. Right hip.	Plays about, wearing a splint which takes the weight off the limb.
Acetab. healthy. Head and neck removed. Left hip.	Death from exhaustion.
Bone disloc. Acetab. gouged. Head and neck removed. Left hip.	Walks with the aid of a splint, which takes the weight off the limb.

Incompleted

No.	Authority.	Sex.	Age.	Time under Treatment.
112	Med. Times and Gaz., May 5, 1860.	M.	11	6 weeks.
113	Lancet, July 24, 1858.	F.	10	2 mos.
114	Med. Times and Gaz., Feb. 7, 1857.	M.	17	3 mos.
115	Ibid., Nov. 1, 1856.	F.	14	3 mos.
116	Ibid., July 22 and Oct. 21, 1854.	M.	8	3 mos.
117	Lancet, July 18, 1857.	M.	12	1 month.
118	Ibid., Oct. 10, 1857.	F.	11	2 mos.
119	Medical Gazette, Aug. 30, 1850.	F.	13	2 weeks.
120	Med. Times and Gaz., Sept. 1, 1860.	M.	4	5 weeks.
121	Arch. f. Klin. Chir., Band I. s. 184.	F.	13	3 mos.
122	Am. Med. Times, Feb. 2, 1861.	M.	17	2 weeks.
123	Lancet, April 22, 1854.	F.	13	18 days.
124	Am. Med. Times, Aug. 4, 1860, and Trans. of Am. Med. Assoc., Vol. XIII.	M.	4	6 weeks.
125	Fock's Table, No. 90.	M.	10¾	2 mos.
126	Med. Times and Gaz., July 17, 1858.			
127	Sayre's Table, No. 58.	F.	9	
128	Ibid., No. 101.	F.	4	3 mos.
129	N. A. Med. Chir. Rev., March, 1858, p. 325.	F.	13	10 days.
130	Private Letter.	F.	21	8 mos.
131	Am. Med. Times, July 6, 1861, and Private Letter.	M.	4	3½ mos.
132	San Francisco Med. Journ., July, 1861.	F.	5	5 weeks.
133	Private Letter.	F.	13	9 mos.

Cases.

Extent of Excision, &c.	Present Condition.
Bone disloc. Acetab. gouged. Head and neck removed.	Doing well.
Bone not disloc. Cut off below trochs. Small portion of ilium removed.	Doing well, and sent to Margate.
Bone disloc. Acetab. diseased. Head and neck removed.	Doing well.
Bone dislocated. Head and neck removed.	Able to lift the limb, but not yet out of bed.
Acetab. gouged. Head and neck removed. Right hip.	Sent to Margate.
Bone disloc. Acetab. gouged. Cut off below trochanters.	Can raise the leg.
Partial disloc. Almost the whole acetab. removed. Cut off below trochanters. Right hip.	"Prospect of successful issue."
Bone disloc. Head absorbed. Acetab. diseased. Cut off below trochanters.	No details.
Partial disloc. Acetab. healthy. Head absorbed. Cut off below trochanters. Right hip.	Moves limb of own accord.
Acetab. gouged. Cut off below trochanters. Left hip.	Wound nearly healed. Symptoms of phthisis.
Upper portion of femur.	Doing well.
Bone disloc. Cut off below trochanters.	Doing well.
Head absorbed. Acetab. gouged. Cut off below trochanters. Left hip.	"Wound healed, with motion."
Cut off through trochanters. Left hip.	Doing well.
	Doing exceedingly well.
Head and neck removed.	Promises a useful limb.
Acetab. gouged. Cut off through trochanters.	Not yet able to bear any weight.
Bone disloc. Acetab. healthy. Head, neck, and 3 in. of shaft removed. Left hip.	Doing well, steadily progressing.
Bone not disloc. Cut off below trochanters. Left hip.	"Gradually running down."
Acetab. gouged. Head and neck removed. Right hip.	Some prospect of recovery.
Acetab. gouged. Head and part of neck removed.	About on crutches.
Acetab. gouged. Head and 3 in. of shaft removed. Right hip.	"Recovery not probable." Sacrum carious.

In the preceding 133 cases, completed and incompleted, 89 patients were males, 38 females, and in 6 the sex is not stated.

Of 79 excisions in which the fact is noted, 36 were of the right hip and 43 of the left. These numbers hardly tend to confirm the observation as to the greater frequency of disease on the left side advanced by Mr. Lonsdale, who says, that of 112 deformities of the hip from disease, presented for treatment at the Royal Orthopedic Hospital, London, 65 were of the left hip and 47 of the right.[1]

Of the 111 completed cases, 56 resulted in recovery with more or less useful limbs, and 53 were fatal, at periods after the operation varying from a few hours to eighteen months. One patient, at the end of four months, underwent amputation, from which he recovered; another, after the lapse of three years and a half, — the disease having returned at the end of one year, — also had his limb amputated, and died two hours after the operation. The rate of mortality, throwing out the case fatal after amputation, appears therefore to be 47.74 per cent. Even adding to these 111 the other 22 cases of which the details are given, but where no definite result had been reached, and considering them all to have terminated in recovery, there would still be a mortality of 39.84 per cent.

Of the patients recovering, 26 were able to walk either with a cane or a high-heeled shoe, and 8 by the aid of crutches or other support for the limb; whilst in 22 the final condition, beyond the mere fact of recovery, is not stated. The disease returned, and a fatal issue resulted, in four cases, viz. Nos. 6, 13, 31, 93, at the end of periods varying from one to three years.

The oldest patients were two men, aged 54, both of whom died of bed-sores, one in 11 and the other in 53 days. The youngest patient was a boy 3 years old, who died twelve months after the operation, of "diphtheritic croup," the condition of the limb at the time not being reported. The average age of those recovering was $11\frac{19}{53}$ years, and of those not recovering $17\frac{32}{45}$ years.

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[1] Lancet, Sept. 8, 1855.

In the most successful cases the condition of the limb appears to have been one of great serviceableness. Mr. Fergusson's first patient, eight years after the operation, was in excellent health, and could walk twenty miles in a day; his limb was perfectly straight, only slightly everted, and had but four and a half inches shortening. The end of the femur might be felt, somewhat rounded, playing easily upon the ilium; either limb could be bent upon the pelvis with almost equal facility; there was a very considerable power of extension and rotation, and also, what has been absent in other cases, of abduction. He wore a high-heeled boot and walked with a stick. The sound limb was a good deal bent, from the knee downwards, to accommodate itself to the deficiency in the other, and there was therefore but little limping in progression.[1] A patient of Mr. Price's was able to join in many of the sports of his companions; and in several instances false joints were obtained, which admitted of very tolerable motion. In almost all the cases which did well, a vastly improved condition of general health ensued, even though, as not unfrequently happened, fistulæ remained open, and more or less discharge continued. In some, however, recovery means only a prolongation of life, with the riddance of an irritating and profusely suppurating sore, death taking place within a year or two, from general disease.

In the fatal cases, the causes of death were as follows, and at the expiration of the time annexed: —

17 of exhaustion, diarrhœa and suppuration; in 6, 4, 3, 3, 2 months; 10, 6 weeks; 39, 26, 20, 16, 11, 11, 8, 4, 4, 4 days.

8 of general disease and phthisis; in 10, 5, 4, 4, 3, 3 months; 10, 5 weeks.

4 of pyæmia; in 18, 16, 13, 8 days.

3 of hemorrhage; in 7, 3 days; "a few hours."

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[1] Med. Times and Gaz., Dec. 4, 1852.

2 of the operation; in "a few days"; 30 hours.

2 of bed-sores; in 53, 11 days.

2 of psoas abscess; in 6 months; 24 days.

4 of erysipelas and phlebitis; in 4 months; 14, 8 days; in one the time is not given.

2 of cerebral disease; in 18, 5 months.

1 of valvular disease of the heart; in 3 months.

1 of Bright's disease; in 11 weeks.

1 of "uræmic convulsions and exhaustion"; in 1 year.

1 of "diphtheritic croup"; in 1 year.

5 from causes not reported; in 30, 10, 7 days; in two the time is not given.

Of these fatal and the two unsuccessful operations, 16 were of the right, and 14 of the left hip; in 25, the side is not stated.

To analyze the table of completed cases still further, it appears that in 64 in which the acetabulum was diseased, the head of the femur is said to have been dislocated in 20, and not dislocated in 18; the head of the bone was absorbed in 4, and in 22 cases its position is not reported.

Of the 20 patients in whom dislocation had taken place, 12 died, and one underwent amputation, and subsequently died.

Of the 18 where no dislocation had taken place, 7 died.

Of the 4 cases where the head of the bone was absorbed, 3 were fatal; and of the 22, in which its position was not stated, 10 were fatal and 12 terminated in recovery.

Of 16 cases where the acetabulum was not diseased, the head of the femur was dislocated in 9, not dislocated in 3, and absorbed in one; in 3 its position is not mentioned.

Of the first category, 4 were fatal; of the second, one. The case in which the head of the bone was absorbed resulted in recovery, and of the 3 in which its position is not given, one was fatal.

Stating these facts in a tabular form, they appear as follows: —

State of the Parts.	Recovered.	Died.
Acetab. diseased and bone dislocated,	7	13
" " " not dislocated,	11	7
Acetab. not diseased and bone dislocated,	5	4
" " " not dislocated,	2	1
" " and head of bone absorbed,	1	0
Acetab. diseased and head of bone absorbed,	1	3

It seems, then, that the greatest mortality accompanied those cases in which the acetabulum was diseased and the bone dislocated, and the least mortality those where the acetabulum was not diseased and the bone dislocated. These facts seem to show, moreover, that dislocation is no evidence of a healthy acetabulum.

Looking simply at the condition of the acetabulum, a mortality of 50.15 per cent follows operations when it is diseased, and of 37.50 per cent when it is healthy. In 58 cases in which the acetabulum was gouged, cauterized, or scraped, there were 28 recoveries and 30 deaths, — one being after a subsequent amputation. This represents a mortality of 51.72 per cent. In 50 cases in which the acetabulum was not gouged, there were 26 recoveries, 23 deaths, and in one case the limb was amputated after the excision, and the patient recovered. Here the mortality is 44 per cent, or 7.72 per cent in favor of non-interference. In 3 cases where the acetabulum was diseased, but not gouged, the result was fatal.

As in the shoulder, therefore, the balance is in favor of partial excision. This is doubtless due to much the same reasons; but especially, perhaps, to the immobility of the pelvis during the processes of cure, as compared with the opposing parts of ginglymoid joints, where partial operations have been so much condemned.

OPERATION AND AFTER-TREATMENT.

THE incisions proper for the performance of excision of the head of the femur will depend in a measure upon the sinuses which exist, the position into which the limb may have become contracted, and upon other circumstances which may be peculiar to individual cases. A curved incision just above the prominence of the great trochanter, with its concavity directed downwards in the long axis of the limb, or a straight one in the direction of the femur, of four to five inches in length, the centre of which shall fall upon that process, are those usually found most convenient.

The precaution should be taken to separate the head of the bone from the acetabulum and its other attachments, before dividing it, as otherwise its removal may prove embarrassing, especially if the head and neck alone are to be excised. The great trochanter, whether diseased or not, should always be removed, as, when left, it is apt to project into the wound, prevent healing, and act as a cap to the acetabulum, obstructing the discharge of pus and of carious portions of the bone.[1] Removal of the shaft of the femur, to an extent exceeding two inches, can hardly be considered justifiable. Any saw, or even a strong pair of bone-forceps, may be used to accomplish the section.

The gouge is the only instrument applicable to the removal of diseased bone from the acetabulum. The exsection, with the saw, of the whole acetabulum, and two instances in which other portions of the os innominatum were removed, are operations that cannot but be strongly condemned, even if sanctioned by so eminent a surgeon as Mr. Erichsen, who boasts of having, on one occasion, excised, with perfect success, "the upper end of the femur, the acetabulum, the rami of the pubes and of the ischium, a portion of the tuber ischii, and part of the dorsum ilii."[2] The same may be said of the application of the actual cautery to the carious cotyloid cavity.

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[1] Fergusson, Pr. Surg. (4th ed., London,) p. 466.

[2] Sc. and Art. of Surg., (3d ed., London, 1860,) p. 745.

The ligature of any blood-vessels seems seldom to be required; but the occurrence of hemorrhage, sufficient to prove fatal, in several of the cases comprised in the table just examined, shows how carefully the wound should be searched and any oozing stanched; remembering that a very slight loss of blood in an enfeebled, anæmic child may turn the scale against recovery.

The subsequent treatment demands little more than rest and the maintenance of the limb in a proper position. A great deal of attention is required to keep it in a right direction with the body. The tendency in the end of the femur to protrude at the wound, is another point to be especially remembered. A bottle of water attached to the foot will partially control this; but no regular extension is usually required, unless previous dislocation has shortened the limb very much by pushing up the head of the femur on the ilium, or when, from long contraction, the limb cannot be completely straightened.

In Mr. O'Leary's successful excision after a gun-shot wound, the limb was placed in a sling, made of strong canvas, which hung from a beam over the man's cot, and the plane of which formed an angle of 20° with the horizon. This method of treatment was adopted in order to promote the approximation of the upper end of the bone to the pelvis, as well as to prevent the lodgement of matter amongst the tissues, and to favor its escape.[1]

Suggested by and in imitation of the above apparatus, there has been used in London, in a number of cases, what is called a "hammock swing." This was contrived by Mr. Heath of King's College Hospital, and consists of a broad sheet of cotton passed under the patient, and perforated with holes to permit the evacuation of the bowels, and for the dressing and discharge of the wound. The ends of the sheet are then attached to what is known in England as "Salter's swing," or a high "cradle." The limb is thus suspended, as in Mr. O'Leary's case.[1] The apparatus seems to have pleased many surgeons who have used it. Some complain, however, that the aperture for dressing the wound is objectionable, as the soft parts become forced into it in such a way as literally to become strangulated, like a hernia.

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[1] Med. Times and Gaz., April 4, 1857.

A very long time must elapse before recovery can be said to be established, although cases will vary in this respect. Thus one patient will leave the hospital in two and a half months, whilst it takes another thirty-four months to reach the same condition. The average time spent under treatment in 49 cases of recovery, where this fact is noted, appears to have been $230\frac{39}{49}$ days.

Constitutional treatment by chalybeates, tonics, etc., and the earliest use of crutches, the sooner to get the patient under hygienic influences, are of course the most important of all measures which can suggest themselves for the promotion of rapid recovery. The splints of Drs. Davis and Sayre, and especially that of Dr. E. Andrews of Chicago, used by its originator with great success, in which the perineum rests upon a crutch-piece extending down the inner side of the limb, and riveted to the heel of the shoe, are, in many instances, admirably adapted to take the place of crutches after excision of the head of the femur.

The success of one of the two cases in which amputation was performed subsequently to the excision, does not justify the course pursued, or encourage a repetition in other cases, where the primary operation either is, or threatens to become, a failure.

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[1] Lancet, Oct. 1857, p. 341.

DISSECTIONS.

A LIMITED number of dissections in cases, where recovery had long been established, have been made, and exhibit a sufficiently favorable condition of the parts.

In Anthony White's case (p. 96), the patient died of phthisis five years after the operation, and the dissected preparation of the parts about the hip-joint is in the museum of the Royal College of Surgeons, London. This shows the end of the femur largely covered with fibrous tissue, and very loosely, though firmly, connected, on the inner side, with a mass of the same structure, filling up the hind part of the hip-socket. The condition may be described as a false anchylosis, with a connecting medium long enough to permit of some movement. The anterior portion of the acetabulum is filled with new bone. There is no appearance of a synovial membrane, capsular ligament, or other part of a true joint.[1]

In the case operated on by Ried (p. 105), where the patient lived a year, pseudarthrosis was established; two rounded processes had shot out from the end of the femur, the upper one being united by a very firm, fibrous substance to a sort of process, developed just below the acetabulum; whilst the other, situated in front of the lesser trochanter, was united in a similar manner to the old articular cavity. The movements of the bone were limited.[2]

A prepared specimen from a patient of the late Mr. G. M. Jones of Jersey (Channel Islands), shows the upper end of the thigh-bone resting against the ilium, — just above the acetabulum, which is partially obliterated, — and bound down to it by a dense and tough fibrous tissue, forming almost a complete capsular ligament.[3]

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[1] South's Chelius, Vol II. p. 980.

[2] Arch. Gén. de Méd., 5^{me} Série, Tom. II. p. 720.

[3] Med. Times and Gaz., Nov. 4, 1854.

In Textor's case (No. 1), where the patient died on the fifty-third day, new osseous development had commenced on the end of the femur, and the cotyloid cavity was filled up with granulations, in which were points of ossific deposit. The femur rested upon the posterior edge of the acetabulum, and had produced there a depression one and a half inches long, an inch wide, and two lines deep.[1]

In a case of Mr. Hancock's, which was dissected twelve months after the operation, the end of the femur rested against the upper margin of the acetabulum, and was enclosed and shut in by a tough capsule, deficient at its posterior part. The end of the bone was rounded off, and the orifice of the medullary tube was partially closed in by a thin plate of bone. It is also said, that "a singular adaptation of parts, in order to compensate for the absence of the cervix femoris, was found; namely, a bending inwards of the descending ramus of the pubes, and of the ascending branch of the ischium."[2]

CONCLUSIONS.

FROM what has been stated, it seems not improper to conclude,—

First, That the earliest excision of the head of the femur was performed by Anthony White of London, in April, 1822; and of the whole hip-joint by Mr. Hancock, December 6, 1856.

Second, That, although excision for injury has been performed but a few times, and with but slight success in saving life, the history of the cases is encouraging, presents a better record than disarticulation, and therefore, as replacing the latter, deserves further repetition.

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[1] Oppenheimer, Ueber die Resection des Hüftgelenkes, p. 50.

[2] Barwell, Tr. on the Dis. of Joints, (Lond., 1861,) p. 447.

Third, That facts are wanting to substantiate the propriety of excision for deformity, necrosis, or malignant disease.

Fourth, That the removal of the head of the femur, spontaneously separated from the rest of the bone in the course of disease, is usually unaccompanied by danger, and — the general condition of the patient permitting — followed by recovery.

Fifth, That the general results of excision for hip-disease are unfavorably modified by disease of the acetabulum, and by efforts to remove this with the gouge; but that dislocation of the head of the femur does not appear to exercise much influence either in favor of, or against, operative interference.

Sixth, That, considering the mortality after the operation, — viz. one death in every $2\frac{5}{53}$ cases, — and the success which follows less heroic methods of treatment, excision for "hip-disease" does not merit a very favorable verdict.

KNEE-JOINT.

HISTORY.

THE first public proposition to excise the knee-joint was made in a letter written by Mr. Henry Park of Liverpool, to Mr. Percival Pott of London, dated September 18, 1782, and published in 1783, entitled, "An Account of a New Method of Healing Diseases of the Joints," etc.; this being "total extirpation of the articulation, or the removal of the extremities of all the bones which form the joint, with the whole, or as much as possible, of the capsular ligament, thereby obtaining a cure by callus, or by uniting the femur and tibia into one bone without any movable articulation."

In the spring of 1781, Mr. Park commenced some long contemplated experiments upon the dead subject, to ascertain the best method of performing this operation, and on the 2d of July of the same year excised the knee-joint of Hector McCaghen, a sailor, aged thirty-three. This patient begån to walk in July, 1782, and eventually "made several voyages to sea, in which he was able to go aloft with considerable agility, and to perform all the duties of a seaman; he was twice shipwrecked, and suffered great hardship, without feeling any further complaint in that limb, but was at last unfortunately drowned by the oversetting of a flat in the river Mersey."[1] On the 22d of June, 1789, Park operated, for the second time, on a man named Charles Harrison, aged thirty. The case, not being well chosen, but unsuited to the operation, both from the condition of the general health and the extensive implication of the soft parts in the disease, terminated fatally, October 13, 1789.

[1] Jeffray's Park and Moreau, p. 47.

The account of this second operation, in a letter to Dr. Simmons, dated September 5th, 1789, and which appeared in the London Medical Journal (Vol. XI., 1790, p. 282), contains an announcement that the publication of his first case had elicited a letter from Mr. Filkin of Northwich to Mr. Binns of Liverpool, claiming priority in the performance of this excision. Unfortunately Mr. Filkin was seized with a paralytic affection, which impaired his faculties, and at last caused his death, before any details of the case could be obtained. His son, however, hunted up the patient, who was still living, and communicated the following facts to Mr. Park. The subject of the operation was a man of a scrofulous constitution, who had had disease of the knee for many years. A fall from a horse fractured his patella, and nearly half a pint of fetid pus ran out by a small wound which opened into the joint. The friends refused to have the limb amputated, as was deemed necessary, and Mr. Filkin, who had once excised the knee on the dead subject, proposed that operation in its stead; this was consented to, and he accordingly performed it, August 23, 1762, removing the patella and the ends of the femur and tibia, which were much diseased. November 21st, the patient had so far recovered that no further attendance was required. The degree of usefulness resulting can only be inferred from the statement of Mr. Filkin, that the man "frequently went to Liverpool," where he would ask him to call and see Mr. Park.

The knee-joint was next excised, September 17th, 1792, by the elder Moreau. Just as a successful result was being reached, the patient died of epidemic dysentery, three and a half months after the operation.[1] In 1809, the operation was performed by Mulder of Groningen;[2] in 1811, by the younger Moreau[3]; and, in 1816, by Roux;[4] but not until

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[1] Jeffray's Park and Moreau, p. 130.

[2] Wachter, De Artic. Extirp., p. 30.

[3] Dict. des. Sc. Méd., Vol. XLVII., Art. *Résection.*

[4] Dict. en 30 Vols., Art. *Genou.*

1823, in which year it was practised in Dublin twice by Sir (then Mr.) Philip Crampton,[1] was it repeated in the United Kingdom. In 1829, and a second time in 1830, it was performed by Mr. James Syme of Edinburgh;[2] as also, in the last-named year, by Jaeger of Erlangen;[3] and subsequently by Fricke, Textor, Demme, Heusser, and others. In 1850, Mr. Fergusson operated in London;[4] and since then the knee has been excised in Great Britain alone several hundred times.

Upon the Continent and in America the operation has been infrequently performed, although in the latter country, within three or four years, the surgeons of hospitals have occasionally undertaken it. Since the excision by Roux, in 1816, it has been repeated in France only on three occasions; viz. by Maisonneuve in 1847,[5] Nélaton in 1851 – 52,[6] and by Follin in 1859.[7]

It was first practised in the United States by Dr. R. A. Kinloch of Charleston, S. C., June 24, 1856;[4] and I am aware of 29 operations having been performed in this country since that date.

Excision of the knee-joint has been performed for injury, for deformity, and for disease.

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[1] Dublin Hosp. Rep., Vol. IV. p. 196.

[2] On the Excision of Joints, p. 135.

[3] Operatio Resectionis Conspectu Chronologico Adumbrata, p. 8.

[4] Lancet, Aug. 10, 1850.

[5] Ibid., Aug. 11, 1849.

[6] O. Heyfelder, *op. cit.*, p. 106.

[7] L'Union Médicale, June 21, 1859.

[8] Am. Journ. of Med. Sc., July, 1859.

EXCISION FOR INJURY.

Upon but few occasions has the knee-joint been excised for traumatic cause. Excepting gun-shot wounds, compound fracture and dislocation, and separation of the epiphysis of the lower end of the femur, are the only injuries, within my knowledge, which have been treated by excision.

The gravest symptoms follow the penetration of the knee-joint by a gun-shot missile. Macleod says: "I have never met with one instance of recovery, in which the joint was distinctly opened and the bones forming it much injured, unless the limb was removed. . . . . . I have conversed with many persons of large experience on the subject, but never heard of any case recovering, without amputation, in which the diagnosis of fracture of the epiphysis was without a doubt. . . . . . In December, 1854, I saw upwards of forty cases in the French hospitals, and all died except those primarily amputated."[1] Esmarch says: "All gun-shot injuries of the knee-joint, in which the epiphysis of the femur or tibia has been affected, demand immediate amputation of the thigh."[2] These opinions are equally those of other military surgeons.

But whether excision may be adopted with any propriety as a substitute for amputation in the class of injuries above described, statistics, unfortunately, do not enable us to decide. Only six instances are known in which it has been practised. One, of complete excision, and a secondary operation, performed in the Crimea, proved fatal after twenty-eight days, from exhaustion and diarrhœa.[3] The second occurred in the Indian campaign of 1857 – 58, where a native soldier underwent amputation of the left thigh and excision of the right knee, immediately after an injury in the affair of Alumbaugh. He died the next evening with symptoms of shock.[1] The third case, a partial excision, the end of the femur alone being removed, was performed by Dr. Fahle, during the Schleswig-Holstein campaign, three days after the injury, and terminated fatally a month after the operation, from tubercular disease, with pyæmic deposits in the lungs and elsewhere. On examination, the cartilage of the tibia was found partially thrown off, and a portion of it was still attached to the bone.[2] The ulceration and discharge necessary for the separation of so extensive a cartilaginous surface might have been avoided, and the chances of recovery perhaps improved, by its removal at the time of the operation. Two cases operated on in 1847 and 1852 by the Textors, father and son, may be cited as additional illustrations of partial excision; one of them was for a gun-shot injury of which we have no details, and the other for compound fracture, with separation of the ligamentum patellæ, and both terminated fatally, from pyæmia, within a few days.[3]

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[1] Surgery of the Crimean War, pp. 310, 315.

[2] Statham's Stromeyer and Esmarch, p. 96.

[3] Med. and Surg. Hist. of the Brit. Army which served in Turkey and the Crimea, (Lond. 1858,) Vol. II. p. 379.

Besides the above instances, the two following, occurring in civil practice, are to be included in the present category.

A man twenty years of age received, at a distance of twelve feet, a charge of No. 6 shot, loaded with a pasteboard wad. It entered above the right knee, and passed through the condyles of the femur into the inner side of the left knee, where the shot penetrated just beneath the skin. The veins, nerves, and arteries of the right leg were not injured. Complete excision of the joint to the extent of three inches was performed, and one inch of the integument was also removed. The patient died of tetanus fifty-two hours after its first symptoms appeared, and ten days after the operation.[4]

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[1] Edinb. Med. and Surg. Journ., Oct. 1860.

[2] Statham's Stromeyer and Esmarch, p. 99.

[3] O. Heyfelder, op. cit., p. 127.

[4] Lancet, April 20, 1861.

A lad, aged nineteen, received a charge of shot in the inner condyle of the left femur, penetrating but not perforating the bone. A slice was excised from each bone so as to furnish a surface for anchylosis, and then the condyle containing the shot was removed by an oblique cut. The patella was left. At the end of three months the patient walked easily with the aid of a stick, and the patella remained loose and movable.[1]

Of these six cases, therefore, but a single one terminated favorably.

For other traumatic causes, the following examples of excision may be cited.

1. A young man fell with his knee on the cutting edge of a scythe. The wound was such that there seemed no other resource than amputation. The patient objected to this, but consented to excision, which was performed. The impossibility of maintaining the extremity of the femur in a fixed position, the rotating muscles of the thigh constantly turning it outwards, together with the profuse suppuration, caused death on the thirtieth day.[2]

2. In 1839, Anthony White operated on a boy seven and a half years old, "whose left leg had been caught in a wheel, which twisted and dislocated the condyles of the thigh-bone through a large transverse wound above the bend of the knee-joint and extending a little in front of either hamstring. The condyles were forced through the legs of his duck trousers, and the attempts to replace the bone were without success; the end of the femur was therefore sawn off, and the shaft immediately dropped into its place." Either from the neglect which, in the night following the operation, permitted him to slip through a hole made in his bed that he might evacuate his bowels without displacing the limb, and so "to be found on the floor in the morning," or for other reasons, it was not until the expiration of eighteen months that the boy was

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[1] Med. Times and Gaz., May 18, 1861.

[2] Blackman's Velpeau, Vol. II. p. 492.

able to walk. After the operation, a large abscess formed over the head of the tibia, and twenty months from the time of the injury the articulating extremity of that bone exfoliated and came away. In 1847, the lad is described as stout and healthy, but no mention is made of his powers of locomotion.[1]

This case, which, like a preceding one, shows the consequences of partial excision, deserves comment for the sake of the surgeon, Anthony White, the first to excise the hip-joint, one of the earliest to excise the knee,—and that too at a time when the operation was under special obloquy,—and, after Dupuytren (1812), the first in Europe (1816) to excise the lower jaw.

3. Mr. Chalmers, of Liverpool, October 13, 1859, excised the right knee of a man forty-four years old, for a wound into the joint, complicated with a compound, comminuted fracture of the patella and rupture of the ligaments. The excision was a complete one, but the patient died of fever, exhaustion, and suppuration, forty-one days after the operation.[2]

4. A boy, eight years of age, came under the care of Mr. Canton, of Charing Cross Hospital, with the shaft of his femur torn from its yet cartilaginous epiphysis by the entanglement of his limb in the spokes of a cart-wheel. It was impossible to keep the boy still in his bed; sloughing ensued, and the femur protruded. The patient being evidently in a failing condition, the ends of the femur and tibia, with the patella, were removed, and a thin slice was also taken from the free end of the femur, that the parts might come into better apposition. The boy's restlessness did not, however, abate, and after a short time the end of the bone again protruded, and another portion was sawed off. Subsequently he progressed favorably, but the union was such as not to admit of utility; and five months after the excision the limb was amputated, at the request

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[1] South's Chelius, Vol. II. p. 982.

[2] Lancet, Dec. 17, 1859.

of the lad's friends. From this operation he recovered at the end of a fortnight.[1]

5. At a meeting of the Pathological Society of London, February 7th, 1860, the last-named surgeon exhibited the epiphysis of the femur, the patella, and a thin slice of the tibia, removed on account of an accident similar to the preceding one, which occurred the October previous, and was followed by a similar history. The case was under treatment at the time of the report, but the subject of it eventually did well, and at the end of a year was able to walk twelve miles without fatigue.[2]

Such is the discouraging catalogue of excisions of the knee-joint for injury, — twelve cases, but three of which proved successful, and one of these only at the end of twenty months, during the whole of which time dead bone was discharged.

Results derived from so small a number of operations do not authorize a comparison with those of amputations, the mortality following which, when performed at the lower third of the thigh for traumatic cause, is 56.6 per cent, in military practice (Macleod); and 60 per cent for primary, and 75 per cent for secondary amputations, in hospital practice (Bryant).

EXCISION FOR DEFORMITY.

The operation of excising the disorganized joint has been not infrequently undertaken, to relieve the deformity produced by the varying degrees of angular anchylosis of the knee, and once, by Mr. Humphry of Cambridge, England, for that resulting from a fractured patella, badly united.[3]

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[1] Lancet, Aug. 28, 1858; and Trans. of the Lond. Path. Soc., 1859, p. 232.

[2] Lancet, Feb. 18, 1860; Dublin Quarterly, Feb. 1861, p. 74.

[3] Med.-Chir. Trans., Vol. XLI. p. 211.

The angular anchylosis to which reference is here made is not the secondary and simply muscular contraction which belongs to almost all diseased knees, but that which is the result of reparative processes, persisting after all active disease has ceased, and which, though ordinarily fibrous, in some cases eventually becomes osseous.

The operation first practised by Dr. Gurdon Buck of New York, October 12, 1844,[1] has taken the place of that of Dr. J. R. Barton, who applied to the knee, in 1835,[2] the same mode of operating which he had already used for the hip in 1826. This last method, though subsequently adopted by other operators (Gibson, Mutter, Pancoast, Post, Burr, Warren, Townsend), leaves an unsightly deformity, resulting from the prominence of the knee, thrown forward in bending the limb, at the point of the bone's section just above the joint. It is, therefore, at least in an operative point of view, advantageously superseded by Buck's procedure, consisting in the removal of a wedge-shaped piece, which includes what were once the articulating surfaces of the femur and tibia.

Although differing in essential particulars from an excision which opens a joint possessing in a greater or less degree some of its normal conditions, the gravity of the operation is not thereby diminished. The difficulties belonging to its execution, and the mortality which accompanies it, render its performance, upon a person otherwise in perfect health, a matter of serious importance. The accompanying table of cases, being all of which I can find any report, although comprising but a small number, is still sufficient to show the truth of this statement.

We have here 19 cases, with 10 recoveries; 8 fatal terminations, in every instance more or less directly due to the operation itself, and one amputation for long delayed non-union of the ends of the bones.

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[1] Am. Journ. of Med. Sc., Oct. 1845, p. 277.

[2] Ibid., Feb. 1838, p. 332.

Age.	Sex.	Result.	Authority.
	M.	Recovered in 9 mos.	Barwell on Dis. of Joints, p. 457.
	M.	Recovered. Union very slow.	Med. Times & Gaz., Oct. 24, '57.
21	M.	Died 30th day. Retention of urine.	Lancet, Dec. 18, 1858.
18	M.	Died, 7th day, of pyæmia.	Med. Times & Gaz., Feb. 24, '55.
	M.	Recovered. On crutches in 3 mos.	N. York Med. Times, Mar. 1854.
14	M.	Recovered. Walked in 4 mos.	Med. and Surg. Reporter, Mar. 16, 1861, p. 648.
19	M.	Died, 30th day, of pneumonia.	Lancet, Jan. 9, 1858.
40	M.	Recovered rapidly.	St. Louis Med. and Surg. Journ., May, 1861, p. 211.
22	M.	Recovered. On crutches in 3 mos.	Am. Journ. of Med. Sc., Oct. '45.
14	M.	Died, 13th day, of tetanus.	Mass. Gen. Hosp. Records.
24	M.	Died, 4th day, of vomiting.	Dublin Quarterly, Feb. 1857.
47	M.	Recovered. On crutches in 1 mo.	Med.-Chir. Trans., Vol. 41, p. 195.
8	M.	Died, 3d day, of shock.	Pemberton on Excision, p. 16.
19	M.	Recovered. Left off crutches in 3 mos.	Boston Med. and Surg. Journ., April 14, 1859.
23	M.	Recovered in 6 mos. 3 in. shortening.	Schillbach, Resect. der Knoch., p. 57.
30	M.	Died, 20th day, of exhaustion.	Ibid., p. 104.
12	M.	Recovered. Walked fairly in 5 mos.	Med.-Chir. Trans., Vol. 41, p. 196.
9	M.	Amp. for non-union at end of 27 mos.	Trans. of Lond. Path. Soc., 1859. p. 220.
—	—	Amp. followed by death from gangrene.	Brit. Med. Journ., Jan. 5, 1861.

According to Mr. Bryant, in 18 amputations of expediency, in the thigh, with which these excisions may very properly be contrasted, the deaths were only one in 3.16 cases.[1]

It is not easy to explain this great mortality, except by attributing it to the difficulties and complications which almost universally attend the operation. The immediate extension of the limb, as in all cases where the hamstring tendons have been long contracted, presents an obstacle not easily overcome. I have known the operation, in more than one instance, to occupy an hour and upwards in its performance. The division of tendons, the removal of several successive slices of bone, and the application of very considerable force, do not always suffice to extend the limb, or bring the sawed surfaces into close apposition. If this is only partially effected, and a gap remains between the bones, a source of irritation is established which endangers the life of the patient.

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[1] Med.-Chir. Trans., Vol. XLII. p. 71.

It may be a question whether gradual extension should not be adopted, as in Barton's method, or whether that operation had not better have remained in vogue, since its success seems to have been considerably greater than that of the one now under consideration. Dr. Sargent, of Philadelphia, gives a series of nine operations with but a single fatal result;[1] and, according to Sédillot,[2] of fifteen cases operated on by Mayor, of Wurzburg, only one died.

The extreme rarity of true osseous anchylosis, and the success of mechanical treatment in the hands of English and German surgeons (especially Mr. Brodhurst and the MM. Langenbeck, of Hanover and Berlin), in cases where only fibrous anchylosis exists, warrant the expectation of results at least as satisfactory without, as with an operation.

EXCISION FOR DISEASE.

ALTHOUGH a case cited by Wachter, where, in the course of several months, a large portion of the articular surface of the knee-joint was extracted in fragments through fistulous openings, and terminating successfully,[3] would seem to suggest the application of this excision to necrosis of the knee-joint, whenever such a rare event occurs, yet I am aware of no instance in which it has been put in execution. The successful removal by J. F. Heyfelder of the upper epiphysis of the tibia, separated by an injury, in a boy ten years old, and the sawing off of the corresponding end of the shaft after suppuration was established, is the nearest approach to such an operation of which I have knowledge.[4] With the exception of three operations, performed for acute inflammation of the articulation,[5] and the anticipated success of two of which in no wise lessens the entire condemnation that such a step deserves, excision of the knee-joint has probably never been undertaken for any other than chronic disease, or "white swelling." The records of Guy's Hospital show that the knee is, of all the joints, the most frequent seat of this affection.[1] Considering its ordinary characteristics, together with the unfavorable prognosis which attends it, and the frequent necessity for amputation, the introduction of an operation calculated to avoid such a contingency demands careful investigation.

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[1] Miller, Principles of Surg. (2d Am. ed.)

[2] Méd. Op., (2me ed.,) Tom. I. p. 536.

[3] De Artic. Extirp., p. 97.

[4] Operationslehre, u. s. w., p. 41.

[5] Lancet, June 20, 1857. Dublin Quarterly, Feb. 1857, p. 18, Case 19. Pemberton, On Excision of the Knee-Joint, p. 19, Case 5.

The questions when and in what sort of cases excision shall be adopted, have been already sufficiently considered (p. 8), and need only be alluded to now, to say that the circumscribed form of tubercular deposit in the articular extremities of the bones, to which alone it is insisted by Mr. Price that excision is applicable, (operations when it is of the infiltrated sort, he says, are sure to be unsuccessful,[2]) is of extreme rarity, seldom if ever being met with. It may also be observed, that it is questionable whether the so-called infiltrated disease is really tubercular.

Apart from those previously given, there are other and numerous considerations which suggest themselves with regard to the application of this particular excision. Setting aside the danger to life, the offices of the limb on which it is performed require results in the matters of length, consolidation, and ability to sustain superincumbent weight, which are not exacted in the upper extremity. The leg can be spared, as a means of progression, better than the hand as an instrument of prehension, and more successful substitutes have been contrived to make its loss less disastrous. There can be no doubt, however, that a limb from which the knee-joint has been excised is sometimes far better than any artificial one; but whether, with Mr. Fergusson, we shall adopt the conclusion, that "in eight cases out of every ten, under the age of twenty or thirty, in which disease of the articulating surfaces of the knee-joint seems incurable, the operation of resection should be preferred to that of amputation,"[1] is a question not to be answered without deliberation.

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[1] Bryant, *op. cit.*

[2] P. C. Price, Contributions to the Surgery of Diseased Joints, with especial Reference to the Operation of Excision, No. I. The Knee, (London, 1859,) p. 12, *et seq.*

The abuses to which the operation has been subjected, as shown by the two tables of Mr. Butcher of Dublin, — there being 19.35 per cent of unfavorable results (deaths and subsequent amputations) in the first table, of 31 cases, not omitting those which were under treatment, and 31.37 per cent in the second, of 51 cases; his struggles to make the mortality of excisions so much less than that of amputations; the reluctant admission of Mr. Price of London, that the real mortality is about the same as, or even in favor of amputation, — the obvious fact being put out of sight that excisions are performed upon selected cases, and that their results ought not, therefore, to be compared on an equal footing with those of amputation of the thigh, practised upon all sorts of cases, no matter how unfavorable; the headlong manner in which some surgeons have entered upon its performance, acknowledged by them in their sensitiveness to the accusation, and in the controversial correspondence which the charge, or its insinuation, has in many instances called forth; the discussion at the Medico-Chirurgical Society to which the report of Mr. Humphry's thirteen cases gave rise; — these are, all of them, circumstances which tend to prove that excision of the knee-joint is not an operation so successful as could be desired.

With all Mr. Park's enthusiasm for his "new method," he was still moderate enough to say: "I beg I may not be so misunderstood, as to have it supposed that I am sanguine enough to imagine that the method I have been recommending will succeed in every case. I know the contrary, and fear that, after the chirurgic art has done all that it is capable of, many of these diseases will still occur in which amputation can alone save the life of the patient."[1]

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[1] Pr. Surg., (4th ed., Lond. 1857,) p. 457.

In the discussion alluded to as following Mr. Humphry's paper, it was made a subject of remark, that whilst that gentleman had operated thirteen times with thirty per cent of subsequent amputation, not a single case adapted to excision had been admitted at St. Bartholomew's Hospital, with a surgical service of 389 beds, for five years; and at the Orthopedic Hospital, where a great number of diseased joints are seen, since 1851, (seven years,) not a single case had been found suitable for this operation; nor, so far as was known, had there been an instance of its performance in the upper ranks of society. The opinion was also expressed by one eminent surgeon, that, when the statistics were collected from various sources, it would be found that the operation was really more dangerous than amputation.[2]

It is apparent, therefore, that a wide difference of opinion exists as to the success and propriety of this excision. The better to ascertain towards which side the weight of testimony leans, I have collected the facts of a large number of operations. I am aware of no tables which approach the following one in the number of its cases, except those of Mr. Price of London,[3] and Dr. O. Heyfelder of St. Petersburg.[4] Although Mr. Price's cases are not presented in a tabular form, or enumerated in detail, it may not be uninteresting to know what results he has arrived at. They may be stated as follows.

From the date of Mr. Fergusson's first operation, July 20, 1850, to the end of December, 1858, the knee had been excised 160 times, six of the operations being for deformity and one for accident. Of these, Mr. Price says, 32 were fatal, or one case in every five; a result which corresponds with that which Mr. Butcher derived from his tables, compiled two years before. Subsequent amputation was required 18 times, and was followed in one case by a fatal result, — which, added to those above given, increases a little the ratio of mortality, making it one in 4.84 cases. To make a comparison between excision and amputation, Mr. Price cites from Teale on "Amputation by Rectangular Flaps," and from Mr. Bryant's "Causes of Death after Amputation." The former says that 169 amputations of the thigh, for disease, were performed in the London hospitals during the three years 1854 – 1857. Of these 38 proved fatal, or about one in 4.5 cases. During the same years, 134 amputations of the thigh for disease were performed in the provincial hospitals, with 33 deaths, or about one in four cases. Mr. Bryant, however, in statistics drawn from Guy's Hospital, has shown that one in 5.5 cases was the proportion of fatal results in pathological amputations of the thigh; and that, for chronic disease of the knee-joint, only one case out of seven proves fatal. From all of which Mr. Price somewhat boldly concludes, that, "comparing the results of excision of the knee-joint with those of amputation for disease, the percentage of successful cases is certainly in favor of the former operation." (p. 42.)

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[1] Jeffray's Park and Moreau, p. 43.

[2] Med. Times and Gaz., March 20 and May 29, 1858.

[3] Contributions to the Surgery of Diseased Joints, &c., &c.

[4] Operationslehre und Statistik der Resectionen, (Wien, 1861,) p. 122.

During the first six months of 1859, Mr. Price had collected particulars of 24 additional cases, of which 4 were fatal from the operation, and 6 required subsequent amputation; of these latter 3 died.[1] This would increase the mortality to one death in 4.6 cases, which hardly sustains the remark quoted at the close of the preceding paragraph. Dr. Heyfelder's table comprises 183 cases, 179 of which had reached a definite result, viz. 125 recoveries and 54 deaths. Amongst these recoveries, however, are included 15 amputations successfully performed subsequent to the excision. These figures exhibit a mortality of one death in $3\frac{17}{54}$ cases.

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[1] R. Druitt, Principles and Practice of Modern Surgery, (8th ed., Lond. 1859,) p. 749.

As a matter of curiosity, I present separately those cases of excision performed prior to the reintroduction of the operation, believing that the circumstances under which they were performed properly exclude them from a table to be relied upon, at the present time, for conclusions. These cases are 30 in number; 17 of them proved fatal, although in 2 death occurred at the expiration of two and three years. In one case subsequent amputation was rendered necessary, and in 12 the patients recovered; 4 of them, however, with a nearly or quite useless limb.

Date.	Surgeon.	Sex.	Age.	Result.	Authority.
1762	Filkin.	M.		Recovered in 3 mos.	Jeffray's Park and Moreau.
1781	Park.	M.	33	" 1 year.	Ibid.
1789	Park.	M.	30	Died in 4 mos.	Ibid.
1792	Moreau, Sen.	M.	20	" 3 mos.	Ibid.
1809	Mulder.	F.	34	Died in 3½ mos.	Wachter de Art. Ext., p.30.
1811	Moreau, Jun.			Recov. Walked badly.	Dict. des Sc. Méd., Tom.47, Art. *Résection*.
1816	Roux.	M.	32	Died in 19 days.	Dict. en 30 vols., Art. *Genou*.
1823	Crampton.	F.	23	Recov. Limb useless.	Dubl. Hosp. Rep., IV. 203.
1823	Crampton.	F.	23	Died in 3 yrs. unheal'd.	Ibid., p. 196.
1829	Syme.	M.	8	Recov. Limb useless.	On Exc. of Joints, p. 135.
1829	Syme.	F.	7	Died in 11 days.	Ibid., p. 138.
1830	Jaeger.	M.	28	Recovered in 1 year.	Arch. Gén. de Méd., Dec., 1853, p. 721.
1832	Textor, d. V.	F.	26	Died.	O. Heyfelder's Tab., No. 14.
1832	Fricke.	F.	8	Recovered.	Ibid., No. 15.
1832	Fricke.			Died. Pyæmia.	Ibid., No. 16.
1832	Fricke.			Died. Hectic.	Ibid., No. 17.
1835	Demme.	M.	36	Recovered in 4 mos.	Ibid., No. 19.
1836	Fricke.	F.	18	Recov. Limb deform'd.	Ibid., No. 18.
1839	Textor, d. S.	F.	32	Died in 4 mos. from exhaustion.	Ibid., No. 20.
1840	Lang.	M.	24	Died in 8 wks. of pyæm.	Ibid., No. 21.
1842	Textor, d.V.	F.	23	Recovery complete.	Ibid., No. 22.
1842	Demme.			Died of pyæmia.	Ibid., No. 23.
1842	Demme.			" "	Ibid., No. 24.
1845	Textor, d.V.	F.	44	Amputat'n; recovery.	Ibid., No. 25.
1845	Textor, d. S.	M.	29	Died in 6 wks. of pyæm.	Ibid., No. 26.
1848	Heusser.	M.	20	Recovered in 4½ mos.	Ibid., No. 27.
1849	Heusser.	M.	32	Partial resect. Died in 2 yrs. of tuberculosis.	Ibid., No. 28.
1849	Heusser.	M.	6	Recovered in 7 weeks.	Ibid., No. 29.
1849	Textor, d. S.	F.	29	Died in 13 days of exhaustion.	Ibid., No. 31.
1849	Heyfelder.	M.	21	Died of pyæmia in 15 days.	J. F. Heyfelder, Amp. und Resect., p. 163.

The following table comprises excisions performed subsequently to 1850, and includes only such as have been undertaken for chronic disease of the joint.

No.	Authority.	Sex.	Age.	Termination.	Time under Treatment.
1	Dublin Quarterly, Feb. 1855.	M.	21	Died.	8 days.
2	Ibid.	F.	25	Recovered.	1 year.
3	Ibid.	M.	11	"	2 years.
4	Ibid.	F.	30	Died.	13 days.
5	Ibid.	M.	7	Recovered.	15 mos.
6	Ibid.	M.	14	"	1 year.
7	Ibid.	M.	20	"	20 mos.
8	Ibid.	F.	21	"	6 mos.
9	Ibid.	M.	42	"	1 year.
10	Ibid.	M.	20	"	3 mos.
11	Ibid.	M.	12	"	10 weeks.
12	Ibid.	F.	28	Died.	16 days.
13	Ibid.	M.	9	Recovered.	7 mos.
14	Ibid.	M.	28	"	
15	Ibid.	M.	9½	"	10½ mos.
16	Ibid.	M.	14	"	2½ mos.
17	B.& F. Med.-Chir.Rev.,Oct.'57, p. 313.	M.	16	Amputat.	
18	Pemberton on Excision.	M.	9	Recovered.	82 days.
19	Dublin Quarterly, Feb. 1855.	M.	18	Died.	24 days.
20	Ibid.	M.	33	Recovered.	8 mos.
21	Ibid.	M.	7	"	1 year.
22	Pemberton on Excision.	M.	12	"	9 mos.
23	Dublin Quarterly, Feb. 1855.	M.	12	Died.	12 days.
24	Ibid.	M.	14½	Recovered.	115 days.
25	Ibid.	F.	15	Amputat.	
26	Ibid.	M.	10	Recovered.	7 mos.
27	Ibid.	M.	8	"	13 mos.
28	Ibid.	F.	20	"	6 mos.
29	Med. Times and Gaz., Jan. 5, 1861.	M.	6	"	6 mos.
30	Ibid.	M.	6	"	4 mos.
31	Dublin Quarterly, Feb. 1857.	M.	10	Amputat.	24 days.
32	Ibid.	M.	10	Recovered.	7 mos.
33	Ibid.	M.	10	Died.	5 days.
34	Ibid.	F.	12	Recovered.	27 mos.
35	Ibid.	F.	20	"	11 mos.
36	Ibid.	M.	14	Amputat.	9 days.
37	Ibid.	F.	27	Recovered.	1 year.
38	Ibid.	M.	4	"	
39	Ibid.	M.	11	"	22 mos.
40	Ibid.	M.	33	Amputat.	7½ mos.
41	Ibid.	M.	18	Died.	17 days.
42	Ibid.	M.	34	Amputat.	38 days.
43	Ibid.	F.	9	Recovered.	2 mos.
44	Ibid.	F.	47	Died.	18 days.
45	Ibid.	F.	5	Unreliev'd.	15 mos.
46	Ibid.	M.	18	Recovered.	3 mos.
47	Ibid.	M.	22	"	5 mos.
48	Edinb. M. and S. Journ., Jan. 1861.	F.	26	Died.	6 days.

Ultimate Result.	Remarks.
	Pyæmia. Patella removed.
Requires artificial support. 3 in. short.	Anchylosis imperfect. Left knee.
Walks, runs, and jumps. 4 in. short.	2 yrs. after operation sound and whole.
	Dysentery.
Walks, runs, & kicks football in 15 mos.	Patella and 4 in. of bone removed.
Walks well without a stick. 3 in. short.	Patella removed.
Can walk 6 miles. Works as a painter.	“ “
Walks well without assistance.	“ “
Walks with ease and celerity.	“ “ Left knee.
Walks 5 miles easily at end of 20 mos.	
Walks well at end of 20 mos.	
	Death from pyæmia. Patella and 3½ inches removed. Left knee.
Perfect, bony anchylosis.	Patella gouged.
Walks with firmness.	Patella and head of fibula removed.
In 15 mos. walks, runs, and plays.	Patella removed.
Useless limb. 7 in. shortening.	2 inches removed. Patella shaved. Right knee.
	Diarrhœa; phthisis.
Walks 12 to 15 miles without fatigue.	Patella removed. Left knee.
Limb anchylosed.	Capacity for walking not stated. Patella scraped.
Limb an encumbrance. 9 in. short.	3½ inches removed. Left knee.
	Phthisis.
In 5 mos. walked a mile.	Patella pared. Right knee.
	Recovery at end of 10 months.
“Not yet permitted to rest on limb.” Eventually walks & runs with little halt.	Patella gouged. Right knee.
Walks and runs without difficulty.	Left knee.
Moves about with aid of a chair.	Joint quite healed.
Walks well without assistance.	After 6 years 5 inches shortening.
Good anchylosis.	Patella gouged.
	Recovery at end of 4 mos. Patella gouged. Left knee.
Can walk, run, and hop. At end of 18 mos. fistulæ and ulcerations.	Patella gouged.
	Exhaustion.
Walks only with a crutch. “At least 6 inches shortening.”	Left knee.
Walks without assistance.	Patella removed. Left knee.
	Recovery in 6 weeks.
Walks 3 or 4 miles without much difficulty. Sinuses still exist at end of 17 mos.	Patella removed.
“Very fair leg” at end of 21 mos.	
Walks without a crutch.	Patella gouged. Right knee.
	Recovery in one month.
	Pyæmia.
	Recovery in 3 mos.
“Runs about famously.”	Patella gouged. Left knee.
	Exhaustion.
“Leg ought to be amputated.”	Partial excision.
Walks without crutches.	Patella scraped.
Walks easily with a high-heeled shoe.	Patella scraped. Right knee.
	Pyæmia.

No.	Authority.	Sex.	Age.	Termination.	Time under Treatment.
49	Dublin Quarterly, Feb. 1857.	F.	20	Recovered.	5 mos.
50	Ibid.	F.	15	Amputat.	6 weeks.
51	Ibid.	F.	30	Died.	5 mos.
52	Ibid.	M.	15	"	3 mos.
53	Ibid.	F.	19	Recovered.	7 mos.
54	Ibid.	F.	15	"	6 mos.
55	Ibid.	F.	26	Died.	10 days.
56	Ibid.	M.	18	Amp. Died.	15 weeks.
57	Ibid.	M.	9	Recovered.	2 mos.
58	Ibid.	M.	29	"	4 mos.
59	Ibid.	M.	20	Amputat.	109 days.
60	Lancet, Nov. 27, 1858.	M.	9	"	27 mos.
61	Dublin Quarterly, Feb. 1857.	M.	27	Died.	24 hours.
62	Ibid.	M.	12	Recovered.	5 mos.
63	Ibid.	M.	37	Died.	11 weeks.
64	Med. Times and Gaz., 1857.	F.	27	"	6 weeks.
65	Dublin Quarterly, Feb. 1857.	F.	26	Recovered.	1 year.
66	Ibid.	M.	26	Died.	13 days.
67	Med. Times and Gaz., July 30, 1859.	M.	31	Amp. Died.	3½ mos.
68	Ibid., Mar. 21, 1857.	M.	39	Amputat.	6 weeks.
69	Ibid., Apr. 30, 1859.	M.	7	"	9 mos.
70	Ibid.	M.	14	Amp. Died.	8 days.
71	Ibid.	M.	10	" "	7½ weeks.
72	Ibid.	M.	15	Amputat.	4 mos.
73	Ibid.	M.	8	Recovered.	5 mos.
74	Lancet, July 9, 1859.	M.	36	Died.	2 weeks.
75	Ibid., Jan. 2 and May 14, 1859.	F.		Amputat.	2½ mos.
76	Ibid., Apr. 9, 1859.	F.	30	Died.	23 days.
77	Med. Times and Gaz., Oct. 17, 1857.	M.	27	"	3 weeks.
78	Ibid.	F.	40	"	6 weeks.
79	Lancet, July 25 and Sept. 27, 1857.	F.	14	"	10 days.
80	Med. Times and Gaz., Oct. 17, 1857.	M.	34	Recovered.	3 mos.
81	Ibid.	F.	10	"	7 mos.
82	Ibid., Dec. 5, 1859.	M.		Amputat.	6 weeks.
83	Lancet, Dec. 18, 1858.	F.	35	Died.	17 days.
84	Med. Times and Gaz., May 8, 1858.	M.	19	"	19 days.
85	Ibid.	M.	37	"	21 days.
86	Ibid., June 5, 1858.	F.	16	"	9 weeks.
87	Ibid., May 29, 1858, and July 20, 1861.	M.	13	Recovered.	3 mos.
88	Ibid., Feb. 6, 1858.	F.		"	
89	Glasgow Med. Journ., Jan. 1856.	M.	12	Died.	29 days.
90	Med. Times and Gaz., Jan. 16, 1858.	M.		Recovered.	
91	Ibid., Aug. 21, 1858.	F.	22	"	7 mos.
92	Ibid.	M.	22	"	4 mos.
93	Dublin Quarterly, Nov. 1857.	M.	27	"	6 mos.
94	Med. Times and Gaz., May 3, 1856.	F.	21	Died.	28 days.
95	Ed. Month. Journ., Vol. III. p. 721.	F.	26	"	21 days.
96	Dublin Quarterly, Feb. 1859.	F.	15	Recovered.	11 mos.
97	Lancet, Apr. 24, 1858.	M.	33	Amputat.	8 mos.
98	Ibid., July 17, 1858.	F.	15	Recovered.	3½ mos.

Ultimate Result.	Remarks.
Walks well and strongly, but with a halt. Some motion between bones at end of 17 mos.	Patella scraped. Right knee.
	Recovery at end of 5 mos. Patella left. Left knee.
	Phthisis.
	Partial excision. Left knee.
Walks with a stick and help of another.	Patella removed.
Walks without stick or crutch.	Patella removed. Left knee.
	Pyæmia. Left knee.
	Died at end of 16 weeks.
Walks easily with a high-heeled shoe.	Left knee.
Walks without crutches.	Patella removed. Left knee.
	Recovered in 5 mos. Left knee.
	Recovered. Right knee.
	Shock.
Walks fairly.	
	Exhaustion. Right knee.
	Anæmia. Right knee.
Can bear any amount of fatigue.	Patella removed at second operation. Left knee.
	Pyæmia.
	Exhaustion, 4 days after amputation. Left knee.
	Recovered at end of 6 weeks.
	Pyæmia, 5 days after amputation.
	Pyæmia, 8 days after amputation.
	Patella removed.
	Pyæmia. Patella removed.
	Recovered.
	Erysipelas. Pat. removed. L. knee.
	Pyæmia.
On crutches in 6 weeks.	
"An excellent limb."	Patella shaved.
	Phthisis. Right knee.
	Pyæmia.
	Exhaustion.
	Exhaustion.
Walks with little lameness. 1⅞ in. removed. At end of 4 yrs. 4½ in. short.	Patella left. Left knee.
Walks with a firm, straight limb.	
	Phlebitis.
In 2 yrs. walks without noticeable limp.	
Walks well without crutch or stick.	Patella removed. Left knee.
Can walk 3 miles with a stick.	Patella makes an unsightly projection. Left knee.
Firm anchylosis.	
	Diarrhœa and exhaustion. L. knee.
	Exhaustion. Left knee.
Firm anchylosis.	Patella removed.
	Recovered in 3 mos.
"All that could be desired."	Patella removed. Right knee.

No.	Authority.	Sex.	Age.	Termination.	Time under Treatment.
99	Am. Journ. Med. Sc., July, 1859.	F.	58	Recovered.	10 mos.
100	Bost. Soc. for Med. Imp., Vol. 3, p.151.	M.	20	"	1 year.
101	Ibid., p. 179.	M.	32	"	5 mos.
102	Mass. Gen. Hosp. Records, 1859.	F.	19	Died.	3 mos.
103	Ibid.	F.	13	Recovered	1 year.
104	Glasgow Med. Journ., Oct. 1859.	F.	18	"	6 mos.
105	Med. Times and Gaz., June 5, 1858.	F.	45	"	8 mos.
106	Ibid.	F.	3	"	
107	Lancet, April 24, 1858.	M.	5	"	3 mos.
108	Med. Times and Gaz., May 8, 1858.	F.	5	Died.	22 days.
109	Ibid.	M.	25	Recovered.	7 mos.
110	Ibid.	M.	35	Amputat.	3 mos.
111	Ibid.	M.	10	"	3 mos.
112	Ibid., June 5, 1858.	F.	18	Recovered.	13 mos.
113	Ibid.	F.	27	"	2½ mos.
114	Ibid., April 16, 1859.	M.	24	Died.	24 days.
115	Ibid.	F.	15	"	4 days.
116	Med.-Chir. Trans., Vol. XLI. p. 211.	M.	13	Recovered.	10 mos.
117	Med. Times and Gaz., Oct. 8, 1859.	M.	11	"	7 mos.
118	Ibid., Oct. 15, 1859.	M.	26	"	2 mos.
119	Edinb. M. & S. Journ., Nov. & Dec.'59.	F.	21	"	3½ mos.
120	Lancet, Dec. 3, 1859.	F.	13	Died.	76 days.
121	Med.-Chir. Trans., Vol. XLI. p. 211.	F.	23	Amputat.	10 mos.
122	Med. Times and Gaz., Apr. 30, 1859.	F.	4	Recovered.	7 weeks.
123	Glasgow Med. Journ., Oct. 1859.	M.	23	Died.	15 days.
124	Med. Times and Gaz., Apr. 21, 1860.	M.		Amputat.	7 days.
125	Pemberton on Excision, p. 13.	M.	7	Died.	19 days.
126	Ibid., p. 17.	F.	30	"	2½ mos.
127	Mass. Gen. Hosp. Records, 1859.	M.	8	Recovered.	3 mos.
128	Med. Times and Gaz., Apr. 21, 1860.	M.	7	"	7 mos.
129	Ibid.	M.	12	"	6 mos.
130	Ibid.	F.	7	"	7 mos.
131	Ibid.		5	Died.	
132	Ibid.	F.	19	"	9 days.
133	Ibid.	F.	10	Recovered.	
134	Ibid., April 28, 1860.	M.	11	Amputat.	8 mos.
135	Ibid.	M.	33	"	3 mos.
136	Ibid.	M.	4	"	9 mos.
137	Ibid.	F.	36	"	1 year.
138	Ibid., May 5, 1860.	M.	25	"	3 weeks.
139	Glasgow Med. Journ., Oct. 1859.	M.	13	Recovered.	15 mos.
140	Ibid.	M.	8	"	9 mos.
141	Ibid.	F.	35	Died.	24 days.
142	Ibid.	M.	19	Amp. Died.	5 mos.
143	Ibid.		10	Recovered.	4 mos.
144	Ibid.		14	Died.	29 days.
145	Med. Times and Gaz., June 2, 1860.	M.	14	"	26 days.
146	Vidal, Vol. V. p. 732.	M.	19	"	
147	Schillbach, p. 45.	M.	33	"	17 days.
148	J. F. Heyfelder, p. 162.	M.	17	Amputat.	11 weeks.
149	Mass. Gen. Hosp. Records.	M.	13	Recovered.	13 weeks.
150	Lancet, July 7, 1860.	M.	11½	"	2 years.
151	Med. Times and Gaz., Aug. 4, 1860.	M.	15	Amp. Died.	4 mos.
152	Lancet, Aug. 4, 1860.	M.	37	Died.	7 mos.

Ultimate Result.	Remarks.
Walks with difficulty.	Patella removed.
Walks with ease.	Right knee.
Walks as well as any one.	Right knee.
	Exhaustion. Left knee.
Walks with tolerable ease.	Left knee.
"Anchylosis perfect."	
Beginning to walk.	
" "	
" "	Patella removed. Left knee.
	Exhaustion. Left knee.
Walks firmly.	Right knee.
	Recovered. Right knee.
	Recovered.
Walks with a stick.	Left knee.
Walks well without a stick.	Patella removed. Left knee.
	Diphtheria and irritation.
	Irritation.
Walks 6 miles without a stick.	
Walks, runs, plays at leap-frog.	Patella removed.
Left with bony anchylosis.	Patella removed. Left knee.
Walks with little lameness.	Patella gouged.
	Diarrhœa. Patella removed. R. knee.
	Recovered.
Walks without assistance.	
	Pyæmia. Left knee.
	Phthisis. Patella removed. R. knee.
Climbs about like other boys.	
	Patella removed. Right knee.
Walks 3 or 4 miles without fatigue.	Patella removed. Right knee.
Walks without assistance.	Right knee.
	Pyæmia. Left knee.
Recovered.	
"	Failing health; hectic.
"	
"	No anchylosis. Disease returned.
"	Failing health. Profuse discharge.
Walks only with crutches.	Left knee.
	Diarrhœa.
	Died of phthisis a year after the amputation. Patella gouged. R. knee.
	"Of shock."
	Died of fatty liver. Patella removed. Left knee.
	Phlebitis of bone.
	Pyæmia. Extensive excision. L. knee.
	Recovery in one month.
Walks very fairly.	Right knee.
Still walks with a splint.	Patella removed. Left knee.
	Died from exhaustion ten days after. Right knee.
	Exhaustion. Left knee.

No.	Authority.	Sex.	Age.	Termination.	Time under Treatment.
153	Lancet, Aug. 4, 1860.	M.	6	Recovered.	8 mos.
154	Ibid.	M.	8	"	15 mos.
155	Ibid.	M.	23	"	7 mos.
156	Med. Times and Gaz., Nov. 10, 1860.	F.	9	"	4 mos.
157	Ibid , Dec. 15, 1860.	M.	25	Amputat.	7 mos.
158	Pemberton on Excision, p. 31.	M.	28	Recovered.	
159	Med. Times and Gaz., Sept. 8, 1860.	M.	10	"	16 mos.
160	Am. Med. Times, Sept. 22, 1860.	F.	30	"	7 mos.
161	Med. Times and Gaz., Nov. 17, 1860.	F.	12	Amputat.	4 mos.
162	Barwell on Dis. Joints, p. 460.	M.	33	Recovered.	3 mos.
163	Ibid., p. 461.	M.	8	"	8½ mos.
164	Ibid., p. 462.	M.		"	5 mos.
165	O. Heyfelder's Table, No. 34.	M.	26	"	5 mos.
166	Ibid., No. 35.	F.	24	Died.	35 weeks.
167	Ibid., No. 36.	F.	18	Amp. Died.	4 days.
168	Ibid., No. 43.	M.	33	" "	
169	Ibid., No. 48.	M.	20	Died.	14 days.
170	Ibid., No. 49.	M.	30	Recovered.	
171	Ibid., No. 50.	F.	10	Died.	35 weeks.
172	Ibid., No. 51.	F.	26	Recovered.	26 weeks.
173	Ibid., No. 52.	M.	20	"	
174	Ibid., No. 53.	M.	18	Died.	
175	Ibid., No. 54.	F.	26	"	
176	Ibid., No. 55.	M.	49	"	
177	Ibid., No. 56.	F.	23	Recovered.	
178	Ibid., No. 69.	M.	16	Died.	10 days.
179	Ibid., No. 91.	M.	23	Recovered.	
180	Ibid., No. 99.	M.	26	Amputat.	
181	Ibid., No. 100.	F.	34	Recovered.	
182	Ibid., No. 101.	M.	33	Died.	17 days.
183	Ibid., No. 140.	M.	35	Recovered.	6 mos.
184	Ibid., No. 141.	M.	17	Died.	13 days.
185	Ibid., No. 143.	M.	18	"	2 mos.
186	Ibid., No. 144.	M.	13	Amputat.	49 days.
187	Ibid., No. 167.			Died.	19 days.
188	Ibid., No. 174.	M.	30	Recovered.	
189	Ibid., No. 175.	M.	22	"	
190	Ibid., No. 176.	F.	28	Died.	5 weeks.
191	Ibid., No. 177.	M.	68	"	6 weeks.
192	Ibid., No. 178.	M.	15	Recovered.	
193	Ibid., No. 183.	M.	43	Died.	4 days.
194	Ibid., No. 46.			"	
195	Ibid., No. 47.			Amputat.	
196	Ibid., No. 67.			Recovered.	
197	Ibid., No. 68.			"	
198	Ibid., No. 172.			"	
199	Ibid., No. 173.			"	
200	Med. Times and Gaz., Apr. 27, 1861.	F.	23	Died.	3 mos.
201	Ibid.	M.	40	Amp. Died.	11 days.
202	Dublin Quarterly, May, 1860, p. 457.	M.	20	Recovered.	3 mos.
203	Am. Med. Times, June 8, 1861.	F.	21	"	1 year.
204	Lancet, May 18, 1861.	F.	17	"	16 mos.
205	Med. Times and Gaz., June 1, 1861.	F.	19½	Amputat.	9 mos.
206	Ibid.	M.	51	"	56 days.
207	Bost. M. & S. Journ., July 11, 1861.	M.	16	"	1 year.
208	Med. Times and Gaz., Aug. 31, 1861.	M.	18	Recovered.	4 mos.

Ultimate Result.	Remarks.
Walks with ease and comfort.	Patella gouged. Right knee.
Walks with ease and rapidity.	Patella gouged.
Able to get about.	Patella gouged.
Walks without crutch or stick.	Right knee.
	Recovered rapidly.
Firm bony union taken place.	Died of phthisis at end of 15 months.
Fibrous union. Much shortening. Crooked limb.	Patella removed. Right knee.
Firm union. Walks well.	Patella removed. Left knee.
	Recovered. Patella removed.
Walks with a stick.	Patella removed.
Walks with a stick.	Patella removed.
Works as a gardener.	Right knee.
Firm union.	
	Phthisis.
	Died at end of 10 months.
	Died of Bright's dis. at end of a year.
	Pyæmia.
Useful limb.	
Re-excised after 20 wks. for non-union.	Exhaustion 15 wks. after 2d operation.
Useful limb.	
	Six inches removed.
	Phthisis.
	Phthisis.
	Pyæmia.
Complete success.	
	Pyæmia.
Useful limb.	
	Recovered.
Fibrous union.	
Useful limb.	
	Exhaustion.
	Recovered.
	Exhaustion.
	Marasmus.
	Phthisis.
	Pyæmia. Patella removed. L. knee.
	Pyæmia.
	Recovered.
	Hemorrhage and suppurat'n. R. knee.
	Died 15 days after amputat'n. R. knee.
Walks well without pain.	Patella scraped. Left knee.
Useful limb; much shortened.	Left. knee.
Walks without assistance.	Re-excised at end of 11 mos. L. knee.
	Recovery. Patella pared. Left knee.
	Recovery. Patella pared. Left knee.
	Five inches of femur removed. Tibia not touched.
Walks without crutches.	Patella removed. Right knee.

I am indebted to the compilation of Mr. Butcher for sixty-five of the foregoing cases, and to that of O. Heyfelder for thirty-five; the rest were derived from various sources, all of which are indicated in the appropriate place.

Of the 208 cases of which the table is made up, 129 were males, and 69 females; in 10 the sex is not stated. Of 75 excisions in which the fact is noted, 29 were of the right, and 46 of the left knee. Of the whole number, 106 recovered and 60 were fatal. In 42 cases the patients underwent subsequent amputation, from which 26 recovered and 9 died, while in 7 the result is not given. The youngest subject in the present table was 3 years of age, and the oldest 68; the former recovered, the latter died. The average age of the patients in whom the operation failed, i. e. who died or underwent amputation, was $25\frac{2}{23}$ years. Of 85 who recovered, the average age was $19\frac{29}{32}$ years. It is asserted that this excision has been performed upon a child only 2 years old.[1]

Of the patients recovering, 65 obtained a useful limb; in 14 the result can be considered only partially successful, the limb being more or less useless; in 27 the simple statement of "recovery" is all which is given. By a "useful limb," is understood one in which there is a solid, straight anchylosis, or, at least, a perfectly firm, fibrous union between the tibia and femur. There should be little shortening; and the patient should possess the ability to walk, to a considerable extent, without pain, and without more assistance than that derived from a cane or splint.

In the fatal cases the causes of death were as follows, viz.: —

Pyæmia	17	Anæmia	1
Exhaustion . .	14	Marasmus . . .	1
Phthisis	9	Shock	2
Diarrhœa and dysentery	3	Erysipelas . . .	1
Phlebitis . . .	2	"Fatty Liver" . .	1
"Irritation" . .	2	Causes not stated . .	7

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[1] Am. Med. Times, Sept 15, 1860.

Death occurred in 1 case at the end of 8¾ months.
" " 1 " " " 7 "
" " 1 " " " 5 "
" " 1 " " " 3¾ "
" " 3 " " " 3 "
" " 4 " in from 9 to 11 weeks.
" " 5 " " 3 to 8 "
" " 14 " " 19 to 29 days.
" " 13 " " 12 to 18 "
" " 8 " " 5 to 10 "
" " 3 " " 1 to 4 "

In 6 cases the period which elapsed is not stated.

The causes which led to subsequent amputation were return of the disease in the bones, the condition of the neighboring soft parts, and the constitutional irritation produced by pain, suppuration, &c., &c. In the 9 fatal cases, death was caused by pyæmia in 2, exhaustion in 2, phthisis in 1, Bright's disease in 1, and in 3 the cause is not stated. In 5 instances the fatal result occurred within 15 days of the amputation; in 2, at the end of one year; and in 2, at the end of 10 months and 16 weeks respectively.

The following figures show the beneficial effects of removing the patella.

There were 8 deaths and 5 amputations in the 61 cases where the patella was either removed or pared, which is a percentage of 21.31; and this, contrasted with the percentage of death and amputation in the other cases, — viz. 60.54, — gives 39.23 per cent in favor of those where it was removed.

Of 48 cases where the patella or its cartilage was removed, and in which recovery took place, the duration of treatment was 225 days. Supposing it to have been left in the 38 other cases of recovery (and it is known to have been in most of them) in which the duration of treatment is stated, and where it was $255\frac{29}{38}$ days, we have a contrast in favor of removal of the patella of about 30 days.

There are then, according to the preceding table, 60 deaths in 208 excisions, or one in every $3\frac{7}{15}$ cases. Counting the deaths, amputations, and those cases terminating in a useless limb, 105, or about one half, are failures of the original operation. Of these failures, 12 were of the right knee, and 21 of the left. In 72 cases the side is not mentioned. This result corresponds in a very striking manner with that derived from Dr. Heyfelder's table, which exhibits a mortality of one in $3\frac{17}{54}$ cases, and also with the summary given by Dr. Krackowizer, of New York, viz. 233 excisions with 63 deaths, and 21 subsequent amputations, or a mortality of one in $3\frac{44}{63}$ cases.[1]

It has been already stated, that, according to Mr. Bryant,[2] one amputation in seven for chronic disease of the knee-joint proves fatal; and this result is confirmed by the statistics of St. George's Hospital,[3] which give precisely the same mortality, and, so far as they go, by those of the Massachusetts General Hospital, where, according to Dr. George Hayward, of 30 amputations of the thigh for white swelling, 4 were fatal.[4] Whether, therefore, we take these figures, or those of Mr. Teale, already cited (p. 140), derived from the provincial hospitals of Great Britain, it will be seen that favorable conclusions with regard to this excision are not sustained by the analysis of cases which has just been given, but that the preponderance on the side of safety is nearly two to one in favor of amputation.

[1] Am. Med. Times, Sept. 25, 1860.

[2] Med.-Chir. Trans., Vol. XLII. p. 71.

[3] Med. Times and Gaz., April 6, 1861.

[4] Surgical Reports and Miscellaneous Papers, (Boston, 1855,) p. 142.

SUBSEQUENT GROWTH OF THE LIMB.

If the manner in which the growth of a bone in length takes place is recalled, — viz. by additions to the two ends of the diaphysis, through the ossification of a cartilaginous stratum existing between each of these and the epiphysis, — it will be understood that, in theory at least, the removal of the end of a bone, in a young person, beyond this dividing line, ought to cause some arrest of its growth. So convinced of this are nearly all the later writers on excision, that the extent of removal in children is made the matter of special caution. This has been particularly insisted upon by Mr. Humphry, an authority in osteology entitled to great respect.[1] He calls attention to the thinness of the epiphysis of the tibia, and reminds operators that epiphyses do not increase in thickness in proportion to the growth of the shaft, but remain nearly the same throughout the period of adolescence. What are the facts bearing upon this point?

The limbs of the boy, eight years old, operated on by Mr. Syme, in 1829, had an unequal growth, and that which was the subject of the operation gradually diminished in length, till, twenty years after, it wanted several inches of reaching the ground.[2] This occurrence led to the sarcastic remark, that "in Sir Patrick Crampton's only successful case, the famous one of Anne Lynch, 'who could walk the length of a day,' it appeared from the bones, bequeathed to the operator by the patient, after her death, and which are now in the Lincoln's Inn Fields Museum, that the tibia and os femoris were united at a right angle, so that the progressive motion must have been of a very rare and remarkable kind; while the subject of Mr. Park's never to be too frequently quoted case probably made a better appearance climbing up the rigging of his ship, like the quadrumanous inhabitant of a tropical forest, than he would have done as a biped on terra firma."[1]

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[1] A Treatise on the Human Skeleton, including the Joints, (Cambridge, Eng., 1858,) p. 44; also Lancet, April 20, 1861.

[2] Contributions to the Pathology and Practice of Surgery, (Edinburgh, 1848,) p. 225.

Mr. Price says that he is aware of one or two instances where the cutting away of the epiphyses has led to an expression of dissatisfaction at the result of the operation. Mr. Butcher endeavors to prove that any apprehensions on this point are unfounded. Mr. Keith, writing to the last-named gentleman in answer to inquiries, says (September 30, 1856): "John Hay's limb, operated on at the age of nine, (two inches being removed), in November, 1853, is plump and growing in length";[2] and yet, three years after making the above report, he writes to Mr. Pemberton that there is a shortening of seven inches.[3] So, in a case operated on by Mr. Pemberton himself, where three and a quarter inches were removed, the leg, which at the end of a year was of equal length with its fellow, six years later is shrunk, blighted, and shortened nine inches. Instead of being the "useful limb" reported by Mr. Butcher, "it cannot be regarded," according to the operator, "otherwise than an encumbrance, little better than a sad deformity."[4] The fear of such a shortening, and apparently, from the drawing accompanying the report, the actual existence of it, is noticeable in the details given of a case operated on at the age of eleven and a half years, by Mr. Heath of London, two years prior to the report.[5] In the case of a boy, six years old, operated on by Mr. Henry Smith, the union was not osseous, and there was a shortening of two and a quarter inches. Five and a half years afterwards, there was perfect anchylosis, but the shortening amounted to five inches, and the boy walked only by the aid of a very cumbrous apparatus.[6] A lad, thirteen years old, whose knee was excised by Mr. Frith of Norfolk, only one and seven eighths inches being removed, and in whom the recovery was rapid and the union osseous, at the expiration of four years had four and a half inches of shortening, and, although able to walk a considerable distance, had been obliged to abandon his former occupation of farm-servant for that of a shoemaker.[3] Such instances as these, few though they be, are a commentary on those cases the later history of which is unknown.

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[1] Edinb. Month. Journ. of Med. Sc., July, 1853.

[2] Dublin Quarterly, Feb. 1857.

[3] On Excision, p. 8.

[4] On Excision of the Knee-Joint, p. 6.

[5] Lancet, July 7, 1860.

[6] Med. Times and Gaz., Jan. 5, 1861.

On the other hand, one would think that cessation in growth ought to be a more common occurrence, were this a certain consequence of too free excision in the early years of life. It might be asked, why we do not hear of this accident happening to the upper extremity; but there it would not necessarily render the limb useless, and hence, if it does really ensue, may pass without special notice. A certain amount of growth undoubtedly takes place through the agency of the epiphysial cartilage, remaining untouched, at the opposite extremity of the bones. In the early part of 1859, there was a discussion at the Société de Chirurgie, of Paris, "sur l'allongement des os après les amputations chez les enfants," and a number of cases of apparent growth of this sort were referred to. It was evident, however, that the question was a new one to those present, and, notwithstanding French loquacity, but little was said, and still less information elicited.[2]

Roux in his thesis (p. 13) quotes Léveillé, "Mémoire sur les Maladies qui affectent les bouts des Os après l'Amputation," as authority for the assertion, "On a vu des pièces d'os, de la longueur de plusieurs pouces, se faire jour à travers la cicatrice, déjà ancienne, d'un moignon bien conformé." Mr. Stanley amputated the arm of a boy aged five; the wound healed, and left a well-formed stump. Three years afterwards, the bone protruded, and an inch of

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[1] Med. Times and Gaz., July 20, 1861.

[2] L'Union Médicale, 17, 24, et 31 Mai, et 7 Juin, 1859.

apparently new growth of bone was removed. Nine years after the amputation, the boy returned again with a similar growth. "This prolongation," says the reporter, "for it is not a protrusion, is a growth of the bone continuous with a growth of the lad's body."[1] Mr. Curling amputated a boy's arm. He made a good recovery, and the end of the bone was well covered. Three years afterwards the humerus projected three fourths of an inch, but of a calibre smaller than the shaft of the bone. This was considered a growth of the bone with the growth of the boy.[2] A boy, twelve years old, whose arm had been amputated seven years, presented himself to Mr. Skey. Six months previously the bone began to emerge, and now projected an inch; it retained its vitality and was covered with periosteum. The end of the bone being cut off, the parts rapidly healed.[3] A young woman, aged eighteen, whose arm had been removed during childhood, the stump healing kindly and remaining healthy, noticed that it had for the last three or four years been gradually becoming conical; at last, from its point, the end of the humerus protruded. "There was no retraction of muscular substance, but clearly an outgrowth of bone, the rest of the stump being healthy." Mr. Hilton cut off three inches of the bone, and the patient did well.[4]

Mr. Palmer, the manufacturer of artificial limbs, whose familiarity with the results of amputation must be very considerable, informs me, that he is not aware that "conical stump" is more frequent, after amputations in childhood, than it is after those of adult life. A statement to this effect, and explained by the supposition that the bone continues to grow, has, however, been made by M. Guersant, of the hospital for sick children, Paris[5]; and also by

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[1] Lancet, Feb. 28, 1857.

[2] Ibid., May 16, 1857.

[3] Med. Times and Gaz., June 2, 1860.

[4] Lancet, Aug. 4, 1860.

[5] L'Union Médicale, 31 Mai et 7 Juin, 1859.

Mr. Pemberton, who mentions a very striking case in illustration.[1]

From these statements on both sides of the question, it seems fair to conclude that extensive removal may lead to a cessation of growth in the bone; and of this proof is given. We also have a single case of its arrest, viz. Mr. Syme's, where only the articulating surfaces were removed.[2] The negative of the question, extensive removal without cessation of growth, depending upon a few cases of which no very long-continued history is given, remains unproved; and although it appears that a certain amount in length is always added to the shaft of a bone, there is no evidence that this is ever sufficient to compensate for any considerable shortening. During adolescence, therefore, operations requiring removal of bone beyond the line of epiphysial junction are liable to terminate ultimately in an unfavorable manner.

In a number of cases in which the limb has not kept up its growth, fibrous anchylosis alone has taken place. This led Mr. Mackenzie of Edinburgh to suggest that it might be itself the cause of the arrest;[3] and Mr. Pemberton, after an investigation of the subject, concludes that "adequate growth is more likely to be attained where care has been taken to remove as small a portion of the articular extremities as possible, and where true anchylosis has resulted."[4] A more probable explanation of this accident seems likely, however, to be found in the experiments of M. Ollier, if these should be confirmed by repetition. This gentleman claims to have shown that the two epiphyses do not effect the same proportion of the growth of long bones, and that those which achieve the most do not correspond in the two extremities. He arrives at the conclusion, that in the upper extremity, for the arm and fore-arm, the epiphyses farthest from the articulation of the elbow grow the most; whilst in the inferior extremity, for the bones of the thigh and leg, the epiphyses nearest to the knee increase to the greatest extent. Therefore, at the elbow, excision cannot cause arrest of development to any considerable degree, since at this point it is by the epiphyses at the other extremity that the greatest growth is effected. At the knee, on the other hand, it will be much more likely to happen, since the femur and tibia lengthen more by the epiphyses forming that joint, than by those at the opposite extremity of the bones. For the same reason, other things being equal, excision of the head of the humerus will lead ultimately to more shortening than that of the head of the femur, and that of the wrist to more than that of the ankle.[1]

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[1] Excision of the Knee-Joint, p. 11.

It is to be borne in mind, that in the lower extremity the benefit of an increase in length, such as has just been described, is in part counterbalanced by the obliquity of the upper epiphysis of the femur; any growth from that end being nearly lost to the limb by its addition in an oblique direction. In the tibia, however, the growth is in the long axis of the bone, and is therefore all gain. This statement is supported by Mr. Pemberton's case of shortening, where the femur lost twice as much as the tibia; and also by Mr. Keith's, where the femur lost four and a half inches, and the tibia only two and a half inches. In both these cases about the same amount was removed from each bone.

[2] Pemberton on Excision of the Knee-Joint, p. 11.

[3] Monthly Journ. of Med. Sc., June, 1856.

[4] On Excision of the Knee-Joint, pp. 12, 13.

OPERATION AND AFTER-TREATMENT.

Various plans have been devised for performing excision of the knee-joint. That in most common use, and the one adopted by Moreau, consists of two lateral incisions and a transverse one just below the patella. The operation introduced by Mackenzie has perhaps been equally popular, viz. a "horse-shoe-shaped" incision, extending from one side of the joint to the other, the convexity of which is directed downwards.[2] The elliptical incision introduced by Mr. Syme, and including the patella between its two curved lines,[1] although occasionally practised, is objectionable, since it removes a portion of the integument.

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[1] Journal de Physiologie de B. Séquard, Vol. IV. No. 13, p. 87.

[2] Edinb. Monthly Journ. of Med. Sc., June, 1853, p. 526.

But no incision is better, because none is more simple, than a transverse one on a line with the articulating surface of the tibia, extending half-way round the limb. First suggested by Park in his second letter, it has been adopted recently by Mr. Fergusson of London,[2] and by Mr. Watson of Glasgow.[3] It freely exposes the articulation without unnecessary linear incisions, and the dependent situation of its two ends favors the discharge of matter, and permits the division of the hamstring tendons, whenever that step is thought desirable, without any additional puncture or incision. The surgeon who is curious in details will find that in the papers of Mr. Butcher the steps of the operation of excision are discussed with all the minuteness he can possibly desire.

In one or two instances the ligamentum patellæ has been preserved undivided. This course was suggested by Mr. Mackenzie,[4] but first put in practice by Mr. Jones of Jersey.[5] The proceeding was a complicated one, and of difficult execution. It was accomplished by drawing the patella and its ligament over the internal condyle whilst the limb was extended; then, forcibly flexing the joint, the articular surfaces of both bones were brought into view, and readily excised.

Any saw is suitable for use in this operation. Great claims have been made for the superiority of special instruments, such as Mr. Butcher's or Mr. Graham's, but I have yet to learn their advantage over the narrow blade which usually accompanies the common bow-saw of amputating-cases. It is not necessary to reverse the edge of this, nor to cut from behind forward. As Mr. Syme says, it is both much easier and much safer to expose the bone sufficiently to permit the application of the saw by free incision, than to overcome the difficulties attending a less complete exposure by any mechanical contrivances.[1] The division of the soft parts and of the crucial ligament permits the head of one bone, by flexing the limb, to be opposed to that of the other, in such a way that the section can be accomplished against it without any risk to the vessels. The soft parts immediately connected with the bones should be sawed, rather than too carefully dissected away, so that the periosteum may be as little interfered with as possible. The removal of a thin, superficial slice, and the subsequent use of the gouge till a good bleeding surface is obtained, will, in most cases adapted to excision, obviate a shortening of the limb which, if the saw alone were used, would perhaps be very considerable. A bevelling of the section, at the expense of the bone posteriorly, allows the limb to unite in a slightly flexed position, more favorable for walking than one which is perfectly straight.

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[1] On the Excision of Joints, p. 136.

[2] Med. Times and Gaz., Nov. 27, 1858.

[3] Glasgow Med. Journ., Oct. 1859.

[4] Edinb. Monthly Journ. of Med. Sc., June, 1853, p. 526.

[5] Med.-Chir. Trans., Vol. XXXVII. p. 69.

It has recently been proposed, in all cases where any considerable amount needs removal, either from the extent of the disease or the nature of a fracture, that the section of the bones should be made, not in the usual transverse direction, but by carrying the saw through each bone obliquely, either from above downwards and from before backwards, or from below upwards and from before backwards. Whenever such a course will include the parts to be excised, and in very many cases it must, a large amount of bone may be removed without causing the great shortening which a transverse section comprising the same extent would necessitate. The common difficulty in making the two transverse surfaces parallel is also obviated by the oblique section. But whether it admits of ready application in practice, or whether the ingenuity of the method in theory is not counterbalanced by the practical difficulty of keeping bones thus sawed in proper apposition, which their resemblance to an oblique fracture at once suggests must be the case, I am unable to say, as it probably has never been adopted in this country. The introduction of this innovation is claimed both for Billroth of Zurich and Pelikan of St. Petersburg.[1]

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[1] On the Excision of Joints, p. 23.

It is a matter of great importance to remove all the diseased synovial membrane, wherever it can be reached; if left, it is often the cause of much irritation, and leads to the formation of fistulæ, which are kept up by the discharge of a pseudo-synovial fluid.[2]

In this connection it may be proper to speak of partial excision, equally to be condemned here as in the elbow. The large cartilaginous surface of either bone, if in a condition sufficiently healthy to be left, must be, if not removed, the seat of a long and painful exfoliation, or the source of profuse suppuration and irritation. In Mr. Butcher's second series, Case No. 16, the head of the tibia was left, "on purpose to see if it could be possible to save it, in our present state of knowledge, without removing it from the body" (*sic;* the case is reported by an Irishman). A year afterwards the unsatisfactory return is, that "the head of the tibia ought still to be excised, although amputation might be thought of by some surgeons, or a firm joint might be got by removing an inch and a half of the head of the tibia."[3] So in Case 23 of the same series, where only the end of the femur was removed, the patient gradually failed, with profuse suppuration, and died two months after the operation.[4] In a case operated on by Dr. Cooper of San Francisco, Cal., the result (amputation at the end of a year, on account of the burrowing of pus) was perhaps as much due to partial excision, as to the extent to which the bone was removed.[1] In 20 partial excisions of the knee,—i. e. of either the end of the femur, end of the tibia, or of the patella,—collected by O. Heyfelder, there were 8 deaths and 4 amputations. The patella alone appears to have been removed with tolerable success only in cases of injury, for which it was done 6 times with a single death; but in 5 instances of its removal for caries there were 3 secondary amputations, and one death.[2]

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[1] O. Heyfelder, *op. cit.*, p. 125.

[2] See a case of Mr. Cadge's in Med. Times and Gaz., Aug. 4, 1860.

[3] Dublin Quarterly, Feb. 1857, pp. 16, 53.

[4] Ibid., p. 21.

In like manner, unfortunate results not infrequently follow when, in an excision, the patella is left unremoved. There are many instances where its subsequent removal was rendered necessary;[3] and a comparison has already been instituted (p. 151) between the cases in which it was left and those where it was excised, resulting, both as to the success and the length of treatment, greatly in favor of the latter. Its retention converts the operation into a partial excision, and in no way contributes to the greater usefulness of the limb. The unconditional removal of this bone is therefore universally advised.

In apposing the sawed surfaces, especial pains should be taken that the soft parts do not bulge up from behind, and interpose between the two bones. This may be avoided by first adjusting the posterior edges of the section. In doing this, care should be taken that the bones do not press too tightly against each other, since this may itself be a cause of trouble.

The removal of bone being accomplished, it is not always easy to bring the limb by extension into a straight position, the tight hamstrings of the flexed knee — so characteristic of disease of that joint, and always present in a deformity which requires the operation — offering a formidable obstacle, not always removed by the sacrifice of successive sections of the bone. I have seen as many as ten slices removed to effect this, and even then with only an imperfect accomplishment of the desired end. The division of the hamstring tendons, as first recommended by Mr. Butcher,[1] — especially of that of the biceps, which, by its insertion into the head of the fibula, is more at fault than the others, — has been often practised as a regular step of the operation, to obviate not only this difficulty, but also the tendency to backward displacement, brought about by the action of their muscles. Their section may be accomplished, as already stated, through the principal incision of the integuments, and no advantage seems to arise from their formal subcutaneous division. Barton, in his operation, which it is true was somewhat different from that under consideration, took two months to straighten the limb.[2] J. F. Heyfelder suggests that, when any difficulty occurs, extension should be deferred for a time, and cites a case where it was not undertaken until ten days after the excision. Unfortunately for his illustration, the patient died five days afterwards of pyæmia.[3] An extension kept up until the muscles are tired out may do much to effect straightening of the limb, as the same course does in fracture of the thigh. At any rate, it is a method which should be thoroughly tried before severer measures are adopted.

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[1] Boston Med. and Surg. Journ., July 11, 1861.

[2] Operationslehre, u. s. w., p. 135.

[3] Lancet, Feb. 27, 1857; Med. Times and Gaz., Dec. 5, 1857.

To facilitate discharge from the interior of the wound, Mr. Holt of London proposes that the popliteal space should always be perforated at the time of the operation.[4] The ends of the large incision can, however, be easily carried far enough backwards to render this procedure unnecessary. From the vicinity of the large vessels, such a course could hardly fail to increase the dangers of the operation, as well as to aggravate the tendency to œdema of the leg, which almost always occurs. This sometimes persistent symptom is due to the blocking up of the veins by the inflammatory processes going on, and is alleviated by position, bandages, etc.

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[1] Dublin Quarterly, Feb. 1855, p. 58.

[2] Am. Journ. of Med. Sc., Vol. XXI. (1838,) p. 336.

[3] Ueber Resect. und Amp., p. 163.

[4] Med. Times and Gaz., Mar. 22, 1856.

The inhalation of ether is especially adapted to the operation of excision of the knee, saving the shock to a worn-out patient, and adding to the ease with which it is performed. What can be more strikingly in contrast with the operation, as it is now witnessed, than the description given by Crampton of the sufferings of his patient? "Four strong assistants could with the utmost difficulty retain her upon the table; the poor girl, whom terror seemed to have deprived of her reason, struggled so violently with both limbs, that it was with a degree of labor and anxiety such as I had never before experienced, that I at length succeeded in detaching the divided extremity of the femur."[1]

Hemorrhage, although rarely severe, is occasionally of a grave character, either at the time of the excision or secondarily. Mr. Syme says the operation is a bloody one, and has thereby given great offence to its advocates.[2] Hemorrhage, "from an artery as large as the radial," required attention, and unstitching of the wound, in Mr. Butcher's first case;[3] and in this gentleman's second table, three instances of severe hemorrhage, one rendering the patient pulseless, are mentioned, viz. Nos. 13, 26, and 28.[4] Mr. Pemberton's sixth patient nearly bled to death.[5] This experience shows how carefully the wound should be searched, and all oozing vessels tied.

Inflammation of the shaft of the bone is an accident liable to occur. This has been spoken of in connection with excision of the elbow, and has also followed excision of the head of the femur. Mr. Pemberton reports its occurrence after excision of the knee, "the thigh-bone becoming two or three times greater than its fellow."[6]

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[1] Dublin Hosp. Rep., Vol. IV. p. 205.

[2] Lancet, Nov. 15, 1856.

[3] Dublin Quarterly, Feb. 1855, p. 26.

[4] Ibid., Feb. 1857.

[5] On Excision of the Knee-Joint, p. 21.

[6] Ibid., p. 26.

Absolute immobility during the after-treatment is all-important; even slight motion interferes with the subsequent solidity of the limb, and movement of the bones upon each other is liable to bring back the disease. Confinement to bed, therefore, must be strict and prolonged; and for a length of time proportionate to the rate of progress there should be the added restraint of an apparatus, the nature and name of which is unimportant, provided it fulfils the condition of preserving immobility in the limb to which it is applied. During the second dressing, if it is attempted before the parts become fixed, displacement of the tibia backwards is liable to occur, unnoticed by the surgeon, who may discover it only when it is too late to be remedied. A considerable length of time after the operation should therefore be allowed to elapse before this is performed; and the intervals between subsequent dressings should also be as long as they can possibly be made. In a number of instances, the later published reports of English surgeons show these to have been sometimes several weeks. The consequences of inattention to the proper steadiness of the limb, or of inability to maintain this, are shown in secondary amputations, inordinate degree of shortening, deformity, and permanent mobility.

During the slow process of healing, the wound frequently takes on a peculiar character, assuming, in spots, a fungous appearance, which is kept up by a slight discharge of matter or serosity, or by small bits of exfoliating bone. It may be questioned whether much mischief is not done, and perhaps this very state produced, by the bone-dust left in the wound and crowded into the cancellous spaces by the action of the saw. This must be discharged as dead matter, and an effort should therefore be made to effect its removal at the time of the operation, either by a sponge, a stream of water from a syringe, or perhaps by means of a brush.

But the most necessary and essential point in the treatment of all excisions is good hygienic influences; and of these pure air is the most important. A part of the success attending the operations performed in London may be attributed to the Hospital for Convalescents at Margate, to which the reports show that many of the patients were sent from the Metropolitan institutions. "Nothing like union took place," says one operator, "until the patient was removed to the sea-side, when he rapidly improved, and came back with a very fair leg." Mr. Fergusson writes: "One of my dressers, who has just been down to Portsmouth, has seen one of my cases, a little girl on whom I operated four or five months since. She made an excellent recovery, but at the end of four or five months there did not seem the least disposition to the formation of bone. The change of air, however, has been most beneficial, and now the leg is firm, and she walks actively about without any assistance."

The length of time required for the cure of excision of the knee is one of the most serious objections to the operation. Whilst, as an extraordinary and altogether exceptional thing, the patient may be upon crutches in six weeks from the time of the operation, with the wound united and a safe amount of consolidation between the bones, and in six months walk more nimbly than he could have done with an artificial limb, it is oftener the case that months elapse before the crutches are reached, and many months more before they are abandoned, even for a cane. A still more discouraging picture than this is drawn by Mr. Barwell, who says: "In what proportion of cases which are returned as with perfect use of the limb, after excision of the knee-joint, a valuable member is retained, it is impossible to say; but that we must not suppose all such limbs to remain useful, I know from having seen two or three men in different institutions, who, as they walked about, and at last out of the hospital perfectly well, justified the report of 'perfectly sound limb,' yet who, at various periods, have returned under care with some defect. The union perhaps yields, and the limb, bending outwards more and more, becomes less and less available; or the man will have gone away with a sinus open: it is justly said, that such sinuses often do remain open for months, and then heal, but sometimes they do not heal, and then a year or two afterwards dead bone will be found, which will require removal."[1] For one patient who, like Mr. Heusser's, in nine months after the operation walks up a mountain 6,500 feet high, and every winter keeps his surgeon supplied with chamois meat and Alpine birds of his own killing, two are found like Mr. Hancock's, operated on in 1858, recovering in five months, and going to work as a gardener; but, after repeated attacks of pain, which would send him to bed for a longer or shorter time, re-entering the hospital, May 5th, 1860, undergoing a second severe operation, and on December 14th — *seven months afterwards* — reported to be "going on well, and promises to recover soundly." Formal re-excision has even been found necessary. A young woman, whose knee-joint had been excised, and who, when she was able to walk across the room with support, was discharged from the hospital as cured, came under the care of Mr. Fergusson, ten months after the operation, with a partial dislocation of the tibia backwards, sinuses, fistulæ, and ulceration of the integument. Mr. Fergusson determined to re-excise the bones, which he did by cutting off one inch of the femur and the upper end of the tibia. At the end of five and a half months she was again discharged with firm union and a straight limb, but with five inches' shortening, and a future history of which we know nothing.[2] A similar course, with a fatal result, was pursued by Heusser, in 1852, for non-union after a resection performed twenty weeks previously.[3]

The extremes of "time under treatment" in my table are 27 months, and 7 weeks: and it appears, from 80 cases in which it is recorded, that the average duration of treatment was 241 days, or about 8 months. According to Mr. Sansom, the average time required for recovery from amputation of the thigh, for diseased bone, is 48 days.[1]

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[1] Tr. on Dis. of the Joints, p. 453.

[2] Lancet, May 18, 1861.

[3] O. Heyfelder, *op. cit.*, p. 118, Case 50.

DISSECTIONS.

As has been already said, nothing of special importance, in connection with the results of this operation, is elucidated by the dissection of the parts involved, long after the excision has been performed. It simply shows the facts, that the early union is fibrous, and that the osseous union, which takes place later, begins first around the periphery of the bones. In cases where the leg swings on the thigh, and requires amputation on account of its uselessness, it is generally found that the ends of the bones are more or less absorbed; the union between them being by bands, stretching from the cut surfaces, and not from the sides. The general nutrition of the limb, wasted by long disease, is rarely regained, and its size is almost always disproportionate to that of its fellow, even after a long lapse of time. Many of the muscles, too, being deprived of their usefulness, undergo fatty degeneration; this is especially the case with those of the thigh.

[1] The Mortality after Operations of Amputation of the Extremities, (Lond. 1859,) p. 19.

CONCLUSIONS.

The preceding pages authorize the following conclusions: —

First, That although excision of the knee-joint was performed by Mr. Filkin, of Northwich, England, in 1762, Mr. Park, of Liverpool, in 1781, first reported a case, and suggested the feasibility of such an operation.

Second, That the small degree of success following the few cases of excision performed for traumatic cause does not warrant inferences favorable to its future adoption as a substitute for amputation.

Third, That excision for anchylosis is followed by such a mortality as to discourage its repetition, especially when the results of orthopedic treatment are remembered, and the fact that a crooked limb is not necessarily useless, nor absolutely a hindrance to self-support.

Fourth, That excision for "white swelling" is followed by a mortality greater than that of amputation for the same cause, — one death occurring in every $3\frac{7}{15}$ operations. Therefore, although occasionally yielding brilliant results, it is an operation to be practised with great reserve.

Fifth, That partial operations upon the knee, as in other ginglymoid joints, add materially to the number of unfavorable cases. As non-removal of the patella converts the excision into a partial one, this bone should never be allowed to remain.

Sixth, That, in young patients, excision beyond the line of junction between the epiphysis and the shaft of the bone is liable to lead to an arrest of growth in the limb operated upon.

ANKLE-JOINT.

HISTORY.

"MR. COOPER, of Bungay, many years ago, sawed off both the head of the tibia and fibula in a compound luxation (of the ankle), by which means he preserved the limb, and made it so useful, that the poor man walks and works for his bread; of which success I am a witness." Mr. Benjamin Gooch,[1] of Norwich, England, in 1758, thus alludes to what is undoubtedly the first recorded case of excision of the ankle-joint, although the operation was a partial one.

According to Wachter, many instances in which two or three, and even four, inches of the ends of the tibia and fibula were removed, after injuries, were related by Bilguer in 1781.[2]

In 1792, the ends of the tibia and fibula were excised by Moreau, with success, nineteen days after the accident of a compound dislocation.[3]

In 1805, Henry Park speaks of a case where the end of the tibia was excised for a compound dislocation, with a most satisfactory result;[4] and Mr. Hey, of Leeds, also says, that, in 1805, Mr. Taylor, a surgeon of Wakefield, showed him five specimens of the lower extremity of the tibia, which he had sawed off after compound dislocations.[5]

The first excision of this joint for disease was by the elder Moreau, April 15, 1792; the patient walked, without halting, at the end of nine months, and his limb was admired by Baron Dubois. It was next performed in 1796, by the younger Moreau, and the patient, though he walked very badly, partly, perhaps, because he ran away from the hospital at the end of six months, still got along without crutches.[1]

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[1] Cases and Practical Remarks in Surgery, 1st ed. (Lond. 1758.)

[2] De Artic. Extirp., p. 29.

[3] Malgaigne, Traité des Luxations, (Paris, 1855,) p. 215. Cited from the younger Moreau's Essay.

[4] Jeffray's Park and Moreau, p. 70.

[5] Practical Observations in Surgery, (1810,) p. 381.

It does not appear, however, that, after the above cases, this operation was again attempted for disease, until 1818, when it was undertaken by Mr. Liston, in Edinburgh.[2] In April, 1830, it was performed in France by M. L. Champion,[3] and in June of the same year by M. Roux.[4] December 27, 1847, Mr. Thomas Wakley, of London, excised the os calcis and astragalus,[5] and in March, 1850, the end of the fibula, together with part of the astragalus.[6] It appears, therefore, that the honor of first performing this operation in Great Britain belongs to Mr. Liston; and of re-introducing it, to Mr. Wakley, rather than to Mr. Hancock, for whose excision of February 17, 1851, it has been claimed.[7]

The only instances of the performance of this operation in the United States, so far as I am aware, are an excision of the astragalus for disease, by Dr. Peace, of the Pennsylvania Hospital, in March, 1853,[8] and of the astragalus and os calcis by Dr. S. Cabot, of Boston, September 3, 1859.[9] The successful removal of the astragalus by Dr. Wells, of Columbia, Georgia, in 1831, six months after an injury,[10] although said to have been performed for caries, was more probably for necrosis; and there is reason to suppose that under similar circumstances such an operation has been practised many times by others.

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[1] Jeffray's Park and Moreau, pp. 140, 146.

[2] Edinb. Med. and Surg. Journ., Jan. 1821, p. 155.

[3] Blackman's Velpeau, Vol. II. p. 487.

[4] Gaz. Hebdom. de Méd., Tom. VIII. p. 214.

[5] Lancet, April 12, 1851.

[6] Ibid., May 25, 1850.

[7] Ibid., Oct. 1, 1859.

[8] Gross. Syst. of Surg., (Philad. 1859,) Vol. II. p. 1093.

[9] Records of Bost. Soc. for Med. Imp., Vol. IV. p. 65.

[10] Am. Journ. of Med. Sc., Vol. X. (1832,) p. 21.

The destruction of the articulation of the ankle by removing the entire astragalus, in cases of dislocation of that bone, appears to have been resorted to as early as the sixteenth century.[1] M. Roux, in his *Rélation d'un Voyage à Londres en* 1814, (p. 209,) after complimenting the surgery of Mr. Hey, of Leeds, who excised the astragalus under these circumstances as early as 1786,[2] says: "Nous pouvons bien parler des cas dans lesquels, — à l'example de Fabrice d'Hilden, — Ferrand, Dessault, L'Aumonier, et plusieurs autres chirurgiens Français, ont extrait complêtement l'astragale dans les luxations compliquées de l'issue de l'os à travers une plaie de l'articulation." Advocated in a very emphatic manner by Sir Astley Cooper[3] and others, this exsection may be considered as an established operation in surgery.

The ankle-joint has been excised in cases of compound dislocation, and for disease; and I have just alluded to the frequency with which exsection of the astragalus has been performed in cases of dislocation, without removing any other parts of the articulation.

EXCISION FOR INJURY.

Excision of the ends of the tibia and fibula is spoken of by all authors in connection with the management of certain compound dislocations of the ankle-joint; viz. those which cannot be reduced, or, if reduced, kept in position, — the laceration not being too extensive, or the contusion such as to threaten sloughing, and when comminution of the other tarsal bones is not an added complication. The case related by Faure, of a soldier at the battle of Fontenoy, wounded in the ankle-joint by a "biscaien," where the ends of the tibia and fibula, together with the astragalus and portions of the other tarsal bones, were removed, can only be regarded as an instance of expectant surgery, as amputation was performed on the forty-seventh day after the accident.[1] The os calcis and part of the astragalus were also removed once with success, in the Crimea, for a gun-shot injury.[2]

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[1] Fabritius Hildanus, Obs. Chirurg., (Frankfurt A. M., 1682,) Centur. II. Obs. 67.

[2] Pr. Obs. in Surg., p. 386.

[3] Tr. on Disloc. and Fract., (Am. ed.,) p. 287, *et seq*.

In speaking of the application of excision to the cases of dislocation above mentioned, Sir Astley Cooper declares, that he has "known no case of death when the extremities of the bones have been sawed off, although he shall have occasion to mention some cases which terminated fatally when this was not done."[3] Malgaigne expresses the opinion, that excision is a less dangerous operation than either simple reduction or amputation, and should be performed according to the exigencies of each case, but not as a general rule. He alludes to a case of dislocation, where, on the fifth day, there was a general spasm, resembling tetanus, loss of consciousness, an almost imperceptible pulse, and a hopeless general condition. The surgeon in charge excised an inch and a half of the tibia, and replaced the bones. The pulse came up the same evening; consciousness returned, and recovery eventually took place.[4]

A remarkable instance is quoted by Vidal, of a young girl who had been buried underneath a slide of earth, by which her feet were turned backwards against the calves of her legs; the tibia and fibula of one side, and the tibia alone of the other, were protruded, the articular cartilages wounded, and the periosteum torn up. Two inches of the right tibia, and an inch and a half of the left tibia and fibula, were excised. Three months afterwards the girl walked with a cane; and this she gave up at the end of another month, although some limping still remained.[1]

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[1] Prix de l'Acad. de Chir., Tom. III. p. 340.

[2] Med. and Surg. Hist. of the Brit. Army which served in Turkey and the Crimea, Vol. II. p. 368.

[3] Disloc. and Fract., (Am. ed.,) p. 251.

[4] Tr. des Fract. et des Lux., Tom. II. (1855,) pp. 1004, 1025.

Mr. Jones, of Jersey, excised the ends of the tibia and fibula, and the surface of the astragalus, twenty-two days after a compound dislocation with fracture of the malleoli, on account of the profuse suppuration, death of the bones, and constitutional disturbance ensuing. The operation was performed on the 18th of April, and on the 23d of July the patient, having for ten days been able to walk some distance without support, ran away from the hospital, and walked five miles with the aid of a stick and a crutch.[2] A similar operation for a similar condition of the parts, five months after an injury (whether fracture or dislocation was not clear), was performed by C. W. Klose, in 1854. The patient was sixty years of age, and at the end of ten weeks was able to walk out with a crutch.[3]

In 29 cases of excision of the ankle for injury, reported in the tables of Jaeger, only a single death is said to have occurred.[4] Malgaigne speaks of the uniform success characterizing the five operations of Taylor, the six of Josse, and the nine of Astley Cooper.[5] And Mr. Kerr, writing to the last-named surgeon, in 1819, says: "Several cases of compound dislocation have fallen under my care, and it has been uniformly my practice to take off the lower extremity of the tibia. . . . . . In my early life, sixty years ago, I saw many attempts to reduce compound dislocations, without removing any part of the tibia; but, to the best of my recollection, they all ended unfavorably, or at least in amputation. By the method which I have pursued, I have generally succeeded in saving the foot."[6]

It is noticeable that this excision, which is always a partial one, is not subject to the unfortunate accidents usually characterizing such operations elsewhere; leaving the articular surface of the astragalus does not seem to retard or complicate the progress of the case, as might be feared.

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[1] Tr. de Path. Ext., (Paris, 3^{me} ed., 1851,) Tom. V. p. 568.

[2] Med. Times and Gaz., Jan. 6, 1855.

[3] H. J. Paul, Die Conservative Chirurgie der Glieder, (Breslau, 1859,) p. 206.

[4] *Op. cit.*, p. 9.

[5] *Op. cit.*, Vol. II. p. 1025.

[6] Cooper, Fract. and Disloc., (Am. ed.,) p. 249.

The operation is usually followed by anchylosis; but in several cases, reported by Astley Cooper, motion was preserved.

Looking at the results of amputation of the leg for traumatic cause, — which show, taking the experience of Guy's Hospital, a mortality of 62.5 per cent in primary, and 66.66 per cent in secondary operations,[1] whilst, according to Mr. Syme, 11 deaths (65 per cent) followed 13 amputations for compound dislocation of the tibia and fibula, performed in the Royal Infirmary of Edinburgh,[2] — conclusions favorable to excision seem fully warranted.

The propriety of removing the astragalus, in cases of its irreducible and double dislocation, from the bones of the leg on one side, and from the os calcis and os scaphoides on the other, seems to be considered a settled point by most surgical writers.

M. Paul Broca, a well-known French surgeon, from an analysis of 160 dislocations of the astragalus, concludes that, —

1st. "In dislocations unaccompanied by a wound, we must attempt reduction. If our attempt fails, we must wait. In the event of an abscess occurring afterwards, we must open it, and subsequently extract the astragalus, — an operation which is then attended by remarkably little danger."

2d. "In dislocations where there is a wound, we must also attempt reduction, having recourse to *débridement* and tenotomy if necessary. When reduction is not possible, the astragalus should be at once removed, as by this operation three fourths of the patients are saved. It is less grave than amputation of the leg, and has the advantage of preserving the functions of the limb."[1]

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[1] Med.-Chir. Trans., Vol. XLII. p. 71.

[2] Edinb. Monthly Med. Journ., Aug. 1844.

"Compound dislocations (of the astragalus), and such as are otherwise complicated," says Dr. Hamilton, "demand of the surgeon immediate amputation or exsection, the latter of which ought to be preferred whenever the condition of the limb encourages a reasonable hope that the foot may be saved."[2]

Mr. Turner, of Manchester, in a voluminous memoir,[3] from an analysis of 46 cases, arrives at conclusions almost identical with those of M. Broca. But it would seem, from an article in the British and Foreign Medico-Chirurgical Review, (July, 1844, p. 124, and October, 1844, p. 565,) that his cases are very imperfectly and sometimes inaccurately reported. It appears from his table, that in 10 cases where the bone was allowed to remain in its new locality, and in 6 of complete reduction, 2 of partial reduction, and 6 of partial excision, recovery took place in all, with more or less permanent lameness. In 18 cases of complete excision there were 14 recoveries (of course with permanent lameness), and 4 deaths. In 4 dislocations the limb was amputated. According to this table, then, the only deaths were after excisions.

The table of Jaeger comprises 27 cases of excision of the astragalus for dislocation, with only one fatal and one doubtful result.[4]

Mr. Jolliffe Tuffnell, Regius Professor of Military Surgery in Trinity College, Dublin, referring to the memoir of Mr. Turner, expresses, in the following words, what may undoubtedly be accepted as a true estimate of this operation. "I am myself," he says, "an advocate of conservative surgery, so far as the objects to be derived from it are real gains and undoubted advantages to the individual; but it may be overdone, as I am convinced it often is in the cases here before us. I am speaking now from the experience of three cases which have come under my own observation, in each of which the bone was removed at different periods after the receipt of the injury, and in each of which the individual gained what would, I am convinced, be reported as a useful foot; but in neither of these three cases can the individual gain his bread."[1]

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[1] Mém. de la Soc. de Chir. de Paris, Tom. II. p. 570.

[2] Pr. Tr. on Fract. and Disloc., p. 702.

[3] Trans. of the Provincial Med. and Surg. Assoc., Vol. XI. pp. 367 - 502.

[4] *Op. cit.*, p. 25.

Anchylosis usually, but not invariably, follows the abstraction of the astragalus, together with a shortening of about an inch. In a case reported in an article on the subject by MM. Rognetta and Deschamps, where the former excised this bone from a patient wounded at the terrible accident on the Versailles Railroad, in May, 1842, there was absolutely no shortening. The quarrels of the doctors over the patient make the fact a well-authenticated one.[2]

EXCISION FOR DISEASE.

According to Mr. Bryant, disease of the ankle-joint occurs with a frequency of about one to four of disease of the hip and knee, in which it is nearly equal and most common.[3]

The extreme difficulty of diagnosticating the precise seat of disease situated in or near the ankle-joint, the insidious manner in which it travels from one bone and articulation to others near it, and the difficulty of exposing the articulation when the bones are in their normal positions, are discouraging circumstances in connection with the performance of excision for caries and articular disease, however well adapted it may be thought for injuries and dislocations, where the amount of lesion is easily ascertained, and the protrusion of the bones renders the removal of their extremities a comparatively easy matter. It is to be borne in mind, also, how much may be, and generally is, comprised in the term "carious disease of the ankle-joint," and that under it may be included a state of things implicating nearly every one of the tarsal bones.

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[1] Dublin Med. Press, Dec. 28, 1853.

[2] Cited in Lond. and Edinb. Monthly Journ. of Med. Sc., Aug. 1843.

[3] Dis. and Inj. of Joints, p. 136.

The history of the operations which have been performed shows, too, how varying is the extent to which excision has been carried by the requirements of a disease, the centre of which was the tibio-tarsal articulation. Whenever more than the surfaces of this joint are diseased, and the removal of the whole astragalus, with perhaps a portion of some other bone, is required, the operation becomes a partial one, — like those already spoken of in connection with the wrist-joint (p. 78), — and one in which the most important condition of successful excision is not fulfilled. The foot is even worse, in this respect, than the hand, since it is usually the bones, and not the articulations, which are primarily diseased: these, from their cancellous and vascular structure, from their distance from the centre of circulation and exposure to variations of temperature, readily become carious; whilst the articulations, remaining healthy, are just in the condition to propagate inflammation, if opened and subjected to its exciting causes.

It must, however, be admitted, that in more cases than might have been anticipated excision of the ankle-joint has resulted in success. Three of Mr. Hancock's four cases were certainly all which could be desired, and justify, perhaps, the remarks he makes upon his own experience, that "in no instance has there been sloughing; there need not be a single tendon divided; there is afterwards very little if any deformity, and comparatively little shortening; the foot is preserved; and, as you will see by the cases I here relate, the patients are able to walk and run about with scarcely any perceptible limp."[1] Of five operations for disease, recorded by Jaeger, four were successful, and in one the result was doubtful.[2]

The reports of cases in which this operation has been performed, demand, I believe, more distrust than any other excision. The insidious manner in which disease of the tarsus works its way about the foot; the unexpected outbreaks which it constantly makes on the slightest provocation, or without any; the great length of time ordinarily required for its cure; and, above all, the variety in opinion as to what constitutes a "useful limb," or what "walking without a limp" means, as well as the precipitate manner in which cases are reported, are all considerations which render the deductions from any table uncertain and unsatisfactory. For instance, conclusions derived from a case like that reported in the Lancet of December 15th, 1855, as "followed by complete success," are set at naught by subsequent statements in the Lancet of January 9th, 1858, and October 1st, 1859, from which it appears that the operation "was not successful, though it promised well at the time," the patient dying six or seven months afterwards.

The results, therefore, to be derived from the following table are to be taken as presenting even more than the brightest aspect of the question. It includes every instance of which I can obtain information, where the integrity of the diseased tibio-tarsal articulation has been interfered with, and comprises operations varying in extent from the removal of a single surface to the exsection of several tarsal bones. Such cases are not, however, improperly classed together; they illustrate the application of the operation to the different conditions of ankle-joint disease, and the fact that the uncertainties of diagnosis prevent its restriction to any precise or prescribed amount of morbid change.

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[1] Lancet, Oct. 1, 1859.

[2] *Op. cit.*, p. 9.

No.	Authority.	Sex.	Age.	Termination.	Time under Treatment.
1	Lancet, April 9, 1859.	M.	6	Recovery.	5 mos.
2	Med. Times and Gaz., May 8, 1857.	M.	31	"	7 mos.
3	Med.-Chir. Trans., Vol. XXXVII. p. 1.	M.	5	"	10 mos.
4	Lancet, Nov. 12, 1853.	M.	15	"	16 mos.
5	Jeffray's Park and Moreau, p. 140.	M.		"	9 mos.
6	Ibid., p. 146.	M.	17	"	6 weeks.
7	J. F. Heyfelder, Ueber Resect. und Amp., p. 169.	M.	35	Amp. Died.	10 weeks.
8	Med.-Chir. Rev., Oct. 1857.			Recovery.	
9	Gross. Syst. of Surg., Vol. II. p. 1093.	M.	11	Recovery.	6 mos.
10	Med. Times and Gaz., July 30, 1859.	M.	26	Amputated.	3 years.
11	Ibid., Oct. 17, 1857.	M.	42	Died.	4 days.
12	Ibid., Jan. 16, 1858.	M.	8	Recovery.	15 mos.
13	Ibid.	M.	15	Amputated.	10 weeks.
14	Ibid., Aug. 7, 1858.	M.	26	"	4½ mos.
15	Lancet, Aug. 25, 1855. Statham's Stromeyer and Esmarch, p. 118.	M.	43	Recovering.	8 mos.
16	Lancet, Oct. 1, 1859.	F.	22	Died.	7 mos.
17	Med. Times and Gaz., Feb. 24, 1855.	M.		Recovery.	
18	Ibid., June 16, 1855.	M.	30	Recovering.	10 weeks.
19	Lancet, Mar. 29, 1851, and Oct. 1, 1859.	M.	8	Recovery.	3 years.
20	Ibid., Nov. 12, 1853.	M.	52	Amputated.	22 days.
21	Ibid., April 12, 1851.	M.	23	Recovery.	7 mos.
22	Ibid., May 25, 1850.	F.	23	Recovering.	7 weeks.
23	Med. Times and Gaz., Nov. 14, 1857.	M.	2	Recovery.	7 mos.
24	Ibid., Jan. 9, 1858, and Oct. 1, 1859.	M.	25	"	3 mos.
25	Glasgow Med. Journ., Vol. II., 1855, p. 1.	F.	18	Died.	6 weeks.
26	Med. Times and Gaz., Nov. 20, 1858.	F.	25	Recovering.	1 month.
27	Lancet, June 18, 1859.	M.		Recovery.	6 mos.
28	Mass. Gen. Hosp. Records.	M.	36	Amputated.	4 mos.

Extent of Removal.	Remarks.
End of tibia and portions of astragalus and os calcis.	Walks without pain. Left leg.
Ends of tibia and fibula; surface of astragalus.	Parts healed, but limb still weak.
Astragalus and part of os calcis.	Complete mobility; walks and runs without pain. Left leg.
Ends of tibia and fibula; surface of astragalus in both feet. Subsequent removal of part of os calcis on both sides.	Both feet quite sound. Walks well with aid of a stick.
Ends of tibia and fibula; surface of astragalus.	Walks without halting. Left leg.
End of tibia.	Walks badly, but without crutches. Left leg.
Ends of tibia and fibula; parts of astragalus and os scaphoides.	Amputation from exhaustion. Death from pyæmia in 7 days. Left leg.
"Ankle-joint and one or more bones of tarsus."	Walked eventually with a stick.
Entire astragalus.	Wounds healed, and some motion.
Ends of tibia and fibula and surface of astragalus.	Amputated at patient's request, having never used the limb.
Ends of tibia and fibula; surface of astragalus.	Death from exhaustion.
End of fibula; part of tibia; whole of astragalus; part of os calcis. 2d operation at end of 5 months.	Tolerable result claimed, but the description is not at all satisfactory. Right leg.
Ends of tibia and fibula; whole of astragalus; part of cuboid bone.	Amputated on account of abscesses and "infiltrating disease." Recovered. Left leg.
Ends of tibia and fibula; surface of astragalus.	Amputated for disease of soft parts. Recovery. Left leg.
Whole of astragalus. Later, ends of tibia and fibula.	Left leg.
End of tibia; surface of astragalus.	Death from phthisis.
End of tibia; whole of astragalus.	Anchylosis, but useful limb. R. leg.
Ends of tibia and fibula; whole of astragalus; part of os calcis; 3 cuneiform bones.	Considerable firmness; able to move foot without support; some discharge. Right leg.
Ends of tibia and fibula; surface of astragalus.	Walks with hardly any limping. Considerable motion in joint. Left leg.
End of tibia; surface of astragalus.	Amputation for exhaustion. Recov.
Ends of tibia and fibula; os calcis and astragalus.	Walks well with a high-heeled shoe. Left leg.
End of fibula; surface of astragalus.	Left hospital in a very satisfactory state. Right leg.
Entire astragalus.	Walks well with an iron support. Left leg.
Ends of tibia and fibula and astragalus.	Two years after operation walks remarkably well.
Ends of tibia and fibula and astragalus.	Death from phthisis.
End of tibia; surface of astragalus.	Wound nearly healed. Ankle movable without pain. Right leg.
Ends of tibia and fibula, astragalus, and part of os calcis.	Useful and strong foot; movable articulation. Right leg.
End of fibula; astragalus and os calcis.	Amputation for returning disease. Recovery. Right leg.

No.	Authority.	Sex.	Age.	Termination.	Time under Treatment.
29	Lancet, Oct. 1, 1859.	M.	6	Recovery.	6 mos.
30	Med. Times and Gaz., Mar. 30, 1860.	F.	10	"	1 year.
31	Edinb. Med. and Surg. Journ., Jan. 1821.	F.	12	"	
32	Journ. Hebdom. de Méd., Vol. VIII. p. 214.	M.	16	"	
33	Jaeger, Op. Resect., p. 26.				
34	Lancet, Oct. 1, 1859.			"	
35	Blackman's Velpeau, Vol. II. p. 487.	M.		"	
36	Ibid.	F.		"	
37	Ibid.			Died.	
38	Statham's Stromeyer and Esmarch, p. 117.	F.	5	Recovery.	18 mos.
39	Path. Cat. of Mus. of Guy's Hosp., p. 192.			Amputated.	7 mos.
40	O. Heyfelder's Operationslehre, p. 163, No. 12.			"	1 year.
41	Ibid., No. 18.	M.	23	Recovery.	
42	Ibid., No. 11.	M.		"	
43	Ibid., No. 16.			Died.	
44	Ibid., No. 17.	M.	5½	Recovery.	4 mos.
45	Ibid., p. 173.	M.	17	Amputated.	24 days.
46	Med. Times and Gaz., Apr. 27, 1861.	M.	12	"	8½ weeks.
47	Ibid.	F.	26	Unsatisfact'y.	
48	Ibid., Aug. 10, 1861.	M.		Recovery.	4 mos.

The preceding table enumerates 48 cases, in 32 of which the patients were males, and in 9 females; in 7 the sex is not stated. In 8 the excision was of the right, and in 12 of the left ankle; in 1 both ankles were excised, and in the remaining 27 the side is not mentioned.

Of these 48 cases, 27 resulted in recovery; in 10, subsequent amputation was performed, of which one died; and in 5, the primary operation proved fatal. In 6 cases the treatment was not completed. Of the 15 cases which proved fatal, or where the patient underwent amputation, the side is stated in 4 only, viz. 3 of the left, and one of the right.

In the 5 fatal cases death was caused by phthisis in 3, pyæmia in one, and in one the cause is not mentioned: it occurred at the end of 7 months, 6 weeks, and 4 days, respectively, — the time not being recorded in one instance.

Extent of Removal.	Remarks.
End of tibia, astragalus, part of os calcis.	Walks without pain. Left leg.
End of fibula and astragalus.	Foot distorted by contraction of tendons.
End of tibia, astragalus, scaphoid and 2 cuneiform bones.	"Lasting cure without much deformity or lameness."
Ends of tibia and fibula, surface of astragalus.	Useful limb.
Astragalus and os scaphoides.	Doubtful result.
Os calcis, astragalus, and cuboid bone.	No details.
Not stated.	"Uses his foot very advantageously."
Not stated.	Repeatedly walked 3 miles to show herself.
Not stated.	
Ends of tibia and fibula and astragalus.	Walks with iron supports. Right leg.
End of tibia and astragalus.	"Never quite healed."
Ends of tibia and fibula and astragalus.	Recovery.
Ends of tibia and fibula, astragalus, part of os calcis and scaphoid.	Movable articulation and little shortening.
Ends of tibia and fibula and astragalus.	Movable joint.
Ends of tibia and fibula and astragalus.	Phthisis.
Ends of tibia and fibula and astragalus.	Movable joint.
Astragalus and os calcis.	Recovery.
Ends of tibia and fibula. Astragalus and os scaphoides.	Recovery.
Ends of tibia and fibula and astragalus.	
Ends of tibia and fibula and astragalus.	"Does not support body in a very satisfactory manner."

In the 10 cases of amputation, that operation was demanded, on account of exhaustion, for returning disease either of the soft parts or of the bones, and for uselessness in the resulting limb.

There appears to be nothing, however, to distinguish either the operation, or the cases which thus failed, from those which proved successful, except the ages of the patients. These range from 2 to 52 years. The average age of those recovering is $12\frac{9}{10}$ years; that of the cases which proved fatal, and of those in which amputation was performed, $27\frac{4}{11}$ years.

The successful operations vary in the extent to which bone was removed, from simple excision of the end of the tibia, to that of the end of the tibia and fibula, with the whole of the astragalus and parts of the calcaneum and three cuneiform bones. The extent of removal does not appear to have much influenced the result; for of the 33 patients who recovered, or who were under treatment, really useful limbs were regained in 22; in 5 the result was not satisfactory; in 5 the patients were doing well; and in one the issue was doubtful.

A very considerable degree of mobility in the new joint, and a very useful limb, free from deformity or much lameness, seem to have characterized some of the successful cases. The first one operated on by Moreau is described by Percy in the following words: "There was no tibio-tarsal articulation, but the astragalus with the scaphoid, and the calcaneum with the cuboid, had acquired such a mobility, that they supplied perfectly the place of the lost joint, and the patient, who wore a high-heeled boot, walked with a very slight limp."[1] Mr. Hancock speaks of one of his patients as "walking, running, and jumping"; and says of another, that "he met him the other day, walking down Hampstead Hill, and he certainly showed no signs of having undergone so serious an operation."[2]

Summing up these statements, we have then 6 deaths, — one being after amputation, — or a mortality of 12.50 per cent; 10 amputations; 5 failures; and one case in which the result was very unpromising. Of 48 cases, therefore, in 21 the object of the operation was not attained; or, in other words, there was a failure in 43.75 per cent. According to Mr. Bryant, in 39 amputations of the leg for disease, there is only a mortality of 1 in 13, or 7.7 per cent.[3]

These figures certainly add force to the remarks of the Medical Times and Gazette of July 30th, 1859, and which — speaking of one of the cases contained in the preceding table, where the limb was amputated, at the patient's request, three years after the original operation, he never having been able to use it — says, that it is only "too good an example of the usual result after excision of the ankle-joint. For the wrist and ankle, where many bones have to be interfered with, the operation of excision seems but ill adapted. We have seen some good results, but we have seen better after treatment by rest and constitutional measures only. The surgeon's knife, and, above all, his gouge, are but too liable to extend the carious ulceration which they are intended to remove. Cases of this class repeatedly disappoint an infinity of care and trouble, and come to amputation at last."

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[1] Dict. des Sc. Méd., Vol. XLVII., Art. *Résection.*

[2] Lancet, Oct. 1, 1859.

[3] Med.-Chir. Trans., Vol. XLII. p. 71.

OPERATION AND AFTER-TREATMENT.

THE operation of excising the ankle-joint is, as has been said, one of considerable difficulty. The necessity of preserving the tendons, as well as the anterior and posterior tibial arteries, and the peculiar tenon-and-mortise character of the joint, render the excision one of no easy execution, unless the disease has so glued the tendons together, cut off the arteries, destroyed the ligaments, and separated the bones, that incisions may be made into the disintegrated and fused tissues, at any point, and the bones easily dislocated and made accessible.

The method of operating usually adopted is that of Mr. Guthrie. A curved incision, commencing behind the outer malleolus, and some distance above its tip, is carried around the extremity of that bone, and then forward and across the front of the foot to the internal malleolus. This incision divides only the integument. The peroneal tendons are next loosened and carried to one side. The lateral ligaments, holding the outer malleolus, being cut, the end of the fibula is removed with the bone-forceps. The division of the internal lateral ligaments is accomplished at the termination of the curved incision on the inner side of the ankle, and in doing this the proximity of the posterior tibial artery is to be borne in mind. The application of a very little force will now dislocate the foot, and expose the surfaces of the bones comprising the joint, which may then be readily excised with the saw, or the whole astragalus exsected.[1]

The tibial arteries will sometimes be divided, either unavoidably or accidentally, or one of the plantar arteries cut across, near its commencement, in removing the astragalus. In only one case, however, have I known this to lead to an alarming hemorrhage.[2]

As has been already intimated, the use of the gouge seems generally to be disapproved of. "So far as my experience goes," says Mr. Erichsen, "gouging operations, even if performed at an early period, are rarely of much benefit. I believe that excision ought, as a rule, to be practised in preference to gouging, contrary to what is the case in the calcaneum."[3]

The application of adhesive straps, in such a way as to keep the osseous surfaces approximated, and yet permit a free exit to all discharge, and the resting of the foot on a pillow, constitute the chief features of the subsequent local treatment.

A deformity resulting from the contraction of the tendon of the tibialis anticus sometimes requires attention when the parts have healed. Its division with a tenotomy knife, in a case capable of improvement, is all which is likely to be necessary.[4]

The length of time required for recovery from this operation is greater than that from any other excision. The average period during which 18 of the successful cases in the preceding table remained under treatment, those being all in which the time is mentioned, was 287⅓ days, or more than nine months. According to Mr. Sansom, the average period required for the healing up of amputations of the leg for "diseased bone," is 42 days.[1]

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[1] Commentaries on the Surgery of the War in Portugal, &c., (5th ed., Lond.,) p. 91.

[2] Edinb. Med. and Surg. Journ., Jan. 1821.

[3] Lancet, June 18, 1859.

[4] Med. Times and Gaz., Mar. 31, 1860.

DISSECTIONS.

DISSECTION of limbs amputated after excision, or where death has taken place after a long interval, the parts being healed, does not furnish anything of interest beyond the facts of the ligamentous union which is established, and an increased mobility in the bones of the tarsus.

CONCLUSIONS.

IT seems proper to conclude: —

First, That the earliest excision of the ankle-joint, of which there is any record, was by Mr. Cooper, of Bungay, England, at some period prior to 1758.

Second, That in compound dislocation of the ankle-joint, not accompanied by too extensive or grave injury of neighboring parts, excision is an operation which often successfully replaces amputation.

Third, That, whilst there may be a propriety in excising the astragalus in compound dislocations of that bone, which cannot be reduced, in other and reducible dislocations, such a step is improper until its preservation has been attempted.

Fourth, That excision of the ankle-joint is followed by a large proportion of failures; 43.75 per cent of all operations being unsatisfactory. Under such circumstances, and in view of the facts that disease of the tarsal bones is insidious, apt to reappear, and its entire removal a matter of uncertainty, this excision ought to be of infrequent performance.

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[1] Mortality after Operations of Amputations of the Extremities, p. 19.

SMALL JOINTS OF THE FOOT.

EXCISIONS practised among the tarsal bones, although they implicate articulating surfaces, belong rather to the excision of bones than the excision of joints. They are usually irregular operations, performed according to the necessities of individual cases, and not after fixed and systemized rules. Fortunately, disease in this locality, especially in young persons, under appropriate constitutional treatment and rest, manifests a strong disposition to recovery without operation.

The removal of one or more tarsal bones has been occasionally attempted from a very early period; and of late years, perhaps from the example of Moreau in 1788,[1] it has become an operation of frequent performance, and usually with a considerable degree of success; often, however, only after repetition, a long lapse of time, and no little patience on the part of the surgeon.

On the 8th of December, 1855, Dr. Henry J. Bigelow, of Boston, removed the whole tarsus, excepting the os calcis and astragalus, together with the tarsal heads of the second and third metatarsal bones, by two incisions corresponding to those of Chopart's and Lisfranc's partial amputations. The patient, unfortunately, died April 21, 1856, from exhaustion, not altogether dependent on the local disease.[2]

This operation was imitated by Mr. Skey, of London, November 27, 1858, and in December the patient was doing well.[3] The ultimate result I am unable to give.

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[1] Jeffray's Park and Moreau, p. 158.

[2] Records of Bost. Soc. for Med. Imp., Vol. II. p. 342.

[3] Lancet, Dec. 4, 1858.

A case cited by Mr. Statham presents some analogies to the preceding one. At a first operation the cuboid and external cuneiform bones were removed; at a second, the scaphoid and the remaining cuneiform; and at a third, the astragalus was scraped, and the tarsal ends of the second and third metatarsal bones were removed. Four years afterwards the patient had a foot in which "the natural appearance was little altered."[1]

For the removal of the os calcis a regular operation is performed. The operations of Mr. Hancock and Mr. Greenhow, in June and August, 1848,[2] are claimed to be the first instances of this. But it was practised by Monteggia, of Milan,[3] twenty-five years before, and also by Heine in 1834.[4] It has now been performed many times for carious disease, and with tolerable success. Of the 12 cases reported by Mr. Greenhow, 10 were successful, and in 2 amputation was subsequently required. The os calcis has also been excised for injury; four operations in the Crimea, in the year 1855-56, having all been followed by a favorable result.[5]

There can hardly be a doubt, however, that gouging is preferable to excision, and better applicable to this bone than to any other of the tarsus; its use in supporting the foot and for the implantation of the tendo Achillis may thus be retained, as a portion of the bone and the attachment of the tendon are preserved by the former operation, but can never be by the latter. It appears, also, that after complete removal by gouging, — the periosteum being left, — the bone has been so nearly reproduced as to have been hardly missed; the tendon obtaining a new insertion, and very satisfactory articulations with the other bones being re-established.[6]

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[1] Med.-Chir. Trans., Vol. XXXVII. p. 5.

[2] Brit. and For. Med.-Chir. Rev., July, 1853, p. 178.

[3] Vaquez, Quelques Mots sur l'Extirpation du Calcaneum. Paris.

[4] Blackman's Velpeau, Vol. II. p. 425.

[5] Med. Times and Gaz., Sept. 13 and 20, 1856.

[6] Arch. Gén. de Méd., 5^me série, Tom. III. p. 677.

Compound dislocations of the great toe at the metatarso-phalangeal articulation are so rare that M. Malgaigne cites but ten instances. Reduction was effected in six of them, for the most part with considerable difficulty; in two the entire metatarsal bone was removed (for what reason does not appear), and in two the head of the dislocated bone was excised. Of these latter, one recovered and the other died. The results which followed the six reductions were one death and three recoveries, with the exfoliation of the articulating surfaces and anchylosis; the fifth patient left the hospital at the end of two and a half months in a condition of which no record is made, and the sixth recovered at the end of seventy days with a movable articulation.[1] In view of these results, and of what we know of its adaptation to compound dislocations in general, and especially when we consider the difficulty which characterizes the reduction of this particular luxation, excision would seem to be the most judicious method of its treatment. The partial removal of the articulation, proposed by M. Letenneur,[2] ought to be rejected, in common with all excisions of that sort.

When diseased, the joints of the toes are, as a rule, more often treated by amputation than excision; the anchylosis and abbreviation, the scars and prominences, which are left by the latter, interfering with comfort when the boot is worn; for although the foot requires a broad surface to sustain weight, and a certain length for easy walking, it can better bear the loss of a toe, than pressure on an irregular and tender cicatrix.

The metatarso-phalangeal articulation of the great toe has, however, been excised quite a number of times for caries. This is claimed to have been first performed, and with success, by Dr. Joseph Pancoast of Philadelphia, in 1836. Kramer and Roux, however, are said by O. Heyfelder (p. 203) to have operated as early as 1826 and

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[1] Tr. des Fract. et Lux., Tom. II. p. 1093.

[2] L'Union Méd., 2 Juillet, 1861, p. 15.

1829.[1] Mr. Hilton, of London, reports a case where the patient, with a stout-soled boot, was able after the operation to walk over the roughest ground almost as easily as ever he could.[2] Mr. Butcher excised this joint successfully, and compensated for the shortness of the inner side of the foot by a thin plate of steel, half an inch wide, introduced into the sole of the shoe.[3] A partial excision performed by Mr. Cock, in which only the head of the metatarsal bone was removed, at the end of a year required amputation.[4] In a case of Mr. Lane's, three months after the operation, the bones had not united, and the necessity of amputation was feared.[5]

During the after-treatment, the extensor tendon sometimes shows a tendency to tilt up the end of the great toe. To obviate this, Dr. Pancoast suggests its subcutaneous division.

The head of the second metatarsal bone, without the corresponding surface of the first phalanx, was excised by Lisfranc, with a successful result at the end of four months; and that of the third, by Velpeau, with recovery in twenty days.[6] M. Chassaignac, upon one occasion, removed three fourths of the anterior extremities of the third, fourth, and fifth metatarsal bones, exarticulating them at their phalangeal connections. In two months the cicatrization was complete.[7] The metatarso-phalangeal articulation of the little toe has been excised by Mr. O'Doherty, of Dublin, and the patient, a girl of sixteen, walked afterwards as well as ever.[8]

In three excisions performed by Fricke, of Hamburg,—one upon the joint between the first and second phalanges of the great toe, for caries, another for an exostosis attached to the head of the first phalanx of the great toe, and the third for a caries of the metatarsal joint of the great toe, — the first patient was able to use the extremity at the end of five weeks; the cure of the second was retarded by necrosis of a portion of the bone until the tenth week, and four weeks sufficed for the restoration of the third.[1] Recovery followed in all the cases (22) of phalangeal excision cited by O. Heyfelder (p. 205).

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[1] A Treatise on Operative Surgery, (Philad. 1844,) p. 132.

[2] Med. Times and Gaz., Aug. 6, 1853.

[3] Dublin Quarterly, Feb. 1859.

[4] Med. Times and Gaz., Dec. 23, 1854, and April 5, 1856.

[5] Ibid., Feb. 18 and May 27, 1854.

[6] Gazette Médicale, Jan. 1837, p. 54.

[7] Bulletin de la Soc. de Chir., 1853, Tom. III. p. 617.

[8] Dublin Quarterly, August, 1859.

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[1] Dublin Quarterly, May, 1837.

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